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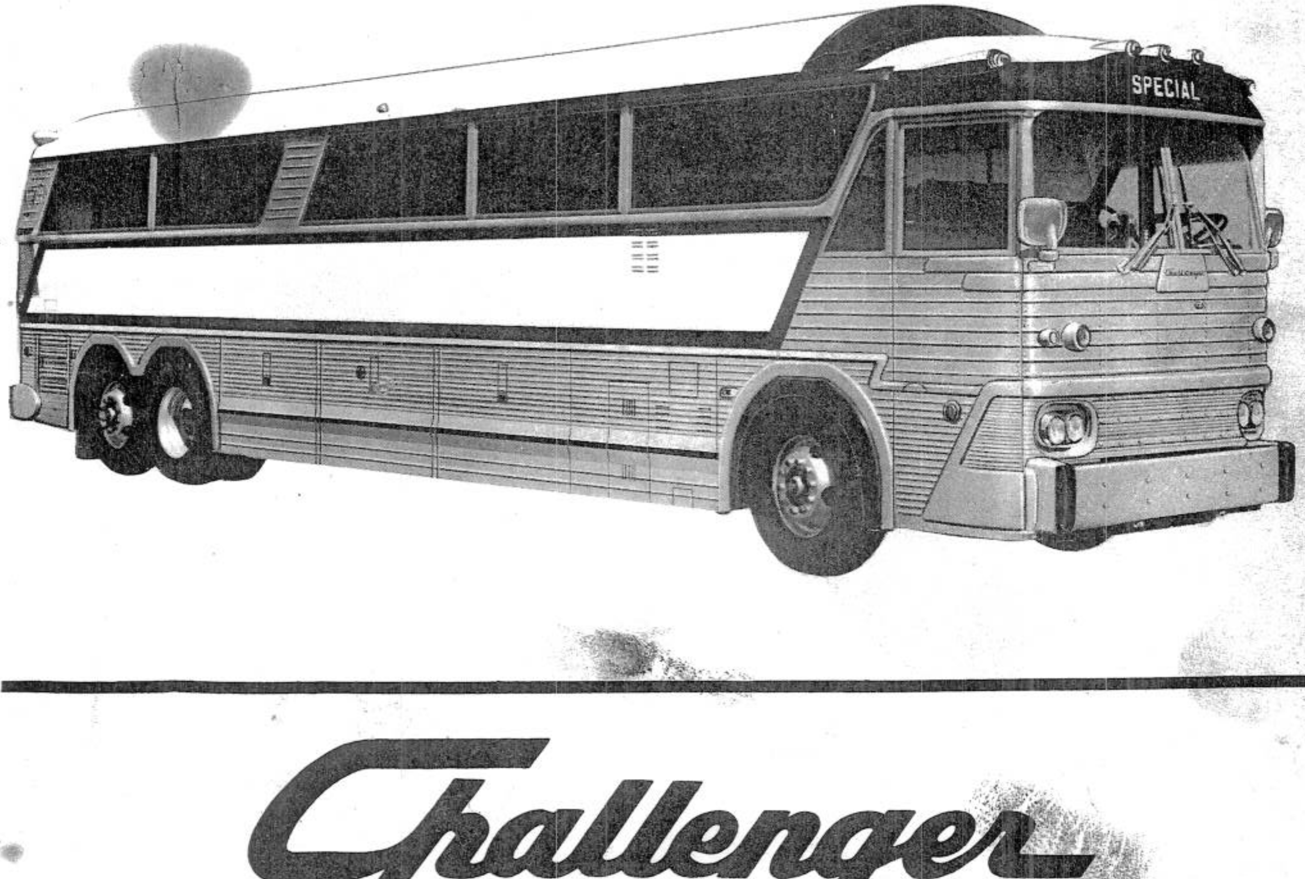
THE BUS HOSPITAL
P. O. BOX 224523
DALLAS, TEXAS 75222

MAINTENANCE MANUAL



Challenger

MODEL MC-7 INTERCITY COACH

MOTOR COACH INDUSTRIES, INC.
PEMBINA □ NORTH DAKOTA □ U.S.A.

IN CANADA –
MOTOR COACH INDUSTRIES LIMITED
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FRONT AXLE

DESCRIPTION

The front axle is of I-beam construction using a forged center and steering knuckles. Steering knuckle pins are tapered, drawn into the axle center by tightening the nut at the upper end of the pin. The pin then becomes an integral part of the axle center.

Steering knuckles are bushed in the upper and lower pin bosses so that they may turn freely about the pins. Bronze bushings with grooves on the inside allow grease to flow uniformly to high-pressure areas. Grease fittings are installed at both upper and lower knuckle pin bosses.

The two steering knuckle assemblies are connected to each other by the tie rod which is threaded at each end and held securely in position by clamps.

Right-hand and left-hand threads are provided to simplify toe-in adjustment.

Wheel bearings, air suspension, steering, and brake parts which are mounted on the front axle are described in the applicable sections of this manual.

FRONT END ALIGNMENT

Correct front end alignment must be maintained for ease of steering and satisfactory tire life. Road shock, viabrations, normal stresses and strains set up in the front end system under average operation can result in loss of front end alignment.

If incorrect front end alignment is suspected, front wheel balance should first be checked to make sure that the difficulties are not originating from out-of-balance front wheels. A check of tire inflation, wheel installation and run out, wheel bearing adjustment, tie rod and drag-link end wear should also be made.

Correct front end alignment can only be maintained when parts in the steering knuckle are in satisfactory condition.

Factors in front end alignment are as follows:

1. Front wheel toe-in: The distance the wheels are closer together at the front than at the rear.
2. Front wheel camber: The amount the wheel inclines from the vertical plane. "Positive" camber means the wheels lean outward at the top. "Negative" camber means the wheels lean inward at the top, and "Zero" camber means that the wheels are in a vertical plane.
3. Axle caster: The fore and aft inclination from vertical of the steering knuckle. "Positive" caster is inclination of the top of the steering knuckle towards the rear of the vehicle. "Negative" caster is the inclination of the top of the steering knuckle towards the front of the vehicle. "Zero" caster means no inclination of the steering knuckle.
4. King pin inclination: The amount king pins are inclined inward at the top.
5. Steering Geometry: The science of keeping the front wheels in proper alignment during left or right turns.

CAMBER ADJUSTMENT

Before checking front wheel camber jack up the front axle of the vehicle and check wheel bearings and steering knuckle pins. To do this attach a camber gauge to the wheel collar, pull outward at the bottom to take up all slack and take the camber reading. If the reading differs more than ¼ of 1 degree, adjust the wheel bearings and repeat the check. If the second reading is still different in excess of ¼ of 1 degree, replace the steering knuckle bushings and pins.

Check wheel run out for excessive wobbling. Correct any discrepancy either by straightening or replacing the wheel.

A final camber reading should be made with the full weight of the coach on a level floor. Camber readings can be made as illustrated in the alignment charts if no camber gauge is available. The difference between the two readings (B minus A) should not vary more than 3/32" ± 1/8" from one wheel to the other.

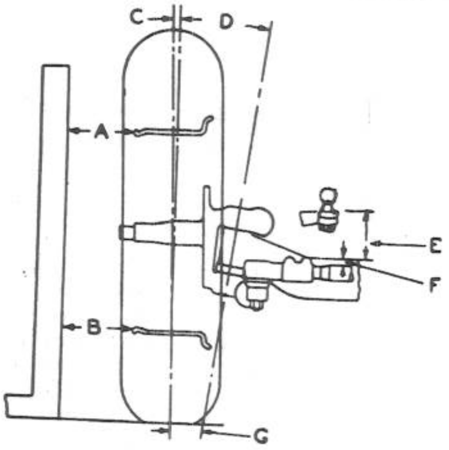
A larger difference is usually due to a bent axle or a bent steering knuckle. To determine if the axle is bent, check the king pin inclination (U minus V on the chart). If the king pin inclination is correct, the trouble is a bent steering knuckle which should be replaced.

FRONT WHEEL TOE-IN

Toe-in is utilized to prevent undue tire wear. To measure and adjust toe-in, the following procedure is recommended:

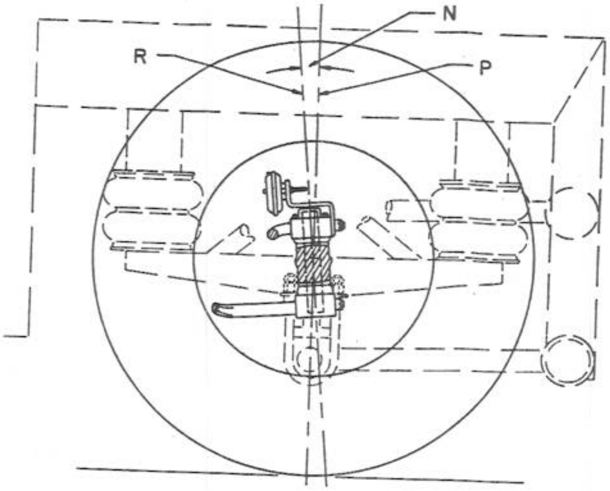
1. Jack up the front axle.
2. Using a piece of chalk, whiten the center area of both front tires around the entire circumference.
3. Position a scribe or pointed instrument against the whitened part of each tire and rotate the tires. The scribe must be held firmly so that a single straight line is scribed all the way around the tire.
4. Place a full-floating turning radius gauge plate under each wheel. Lower the vehicle and remove the lock pins from the gauge plates. If full-floating turning radius gauge plates are not available, lower the vehicle and move it backward and then forward approximately six feet.
5. Set the sliding scale end of a trammel bar on zero and lock in place. Position the bar at the

FRONT WHEEL ALIGNMENT CHART



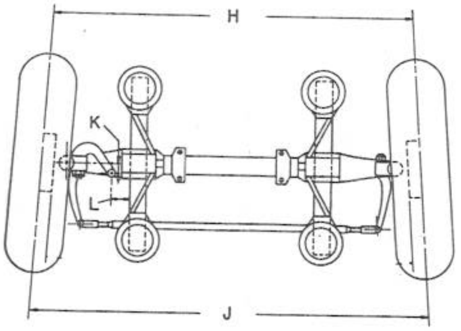
B. Minus A	Camber (inches)
C	Camber (degrees)
D	Pin Inclination
E	Drag Link Arm Above Spring Seat
F	Top of Tie Rod Below Spring Seat
G	Tire Overhang

CAMBER, PIN INCLINATION, ARM & ROD LOCATIONS.



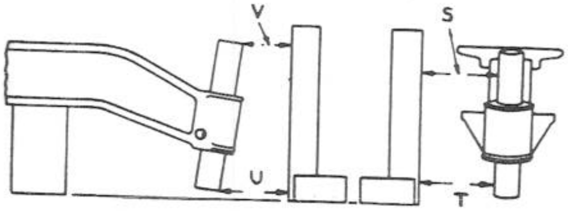
N	Caster Angle
R	Knuckle Pin CL
P	Vertical

FRONT AXLE CASTER



J. Minus H	Toe-In
K	Relation of Link Arm to Axle Centre
L	Centre of link Arm to Edge of Spring

TOE-IN, ROD, & ARM LOCATIONS



T Minus S	I Beam Twist
U Minus V........	Pin Inclination

AXLE CENTER TWIST & PIN INCLINATION

Refer to "SPECIFICATIONS" for Correct Dimensions rear of the tires and adjust the pointers to line up with the scribe lines on the tires and lock in place. (Scale still set at zero.)

6. Place the trammel bar at the front of the tires. Adjust the scale end so that the pointers line up with the scribe marks.
7. Read toe-in or toe-out from the scale. Scale should read toe-in 1/16". (Tolerance ±1/16.)
8. If adjustment is necessary, loosen the tie-rod clamps and turn tie-rod as required then tighten the clamps. If the vehicle is not on gauge plates, move it backward then forward about six feet.
9. Recheck the toe-in to ensure that it is correct.

STEERING GEOMETRY

Steering geometry is dependent on the design of the front end components. Field adjustments are not possible, but a check should be made to see that steering arms, linkage and other parts are properly installed and are not bent and distorted. Bent or damaged parts should be replaced. The alignment chart includes measurements which can be made to determine satisfactory condition of front end parts.

MAINTENANCE

Periodic inspection of the front axle assembly should be made to see that all bolts are tight and that no damage and distortion has taken place. Suspension support stud nuts, U-bolt nuts, tie-rod arm and steering arm nuts, and stop screws should be checked and tightened if necessary to the torque specifications shown at the end of this section. Attention should also be given to the condition of the steering knuckle pins and bushings. If excessive looseness is found at this point, the bushings and pins should be replaced.

LUBRICATION

Periodic lubrication according to the recommendations in the lubrication section of this manual should be carried out. Points which require lubrication are the steering knuckle pins, tie-rod ends, and drag link ends. These are provided with grease fittings for pressure lubrication.

Refer to Section 12 (Suspension) for details of procedures necessary to remove and install the front axle assembly.

Steering knuckles, king pins, and bushings may be replaced without removing the axle from the coach. Tie-rod and drag link ends may also be replaced without removing the axle.

If extensive overall work or straightening of the front axle center are necessary, the axle should, of course, be removed.

CASTER

The purpose of caster angle ("N" on the chart) is to give a trailing effect. This results in stabilized steering and a tendency of the wheels to return to the straight ahead position after making a turn.

Excessive caster results in hard steering around corners. A shimmy may also develop when returning to the straight ahead position.

Insufficient caster will cause wandering and weaving.

Caster variations may be caused by a bent axle, tilting or distortion of side suspension supports, or unequal tightening of the front and rear suspension support bolts.

KING PIN INCLINATION

The purpose of king pin inclination (B on the chart) is the same as the purpose of camber. A check of the king pin inclination may be made by measurement (U and V on the chart). The use of proper instruments in making these measurements cannot be overemphasized.

STRAIGHTENING AXLE CENTER

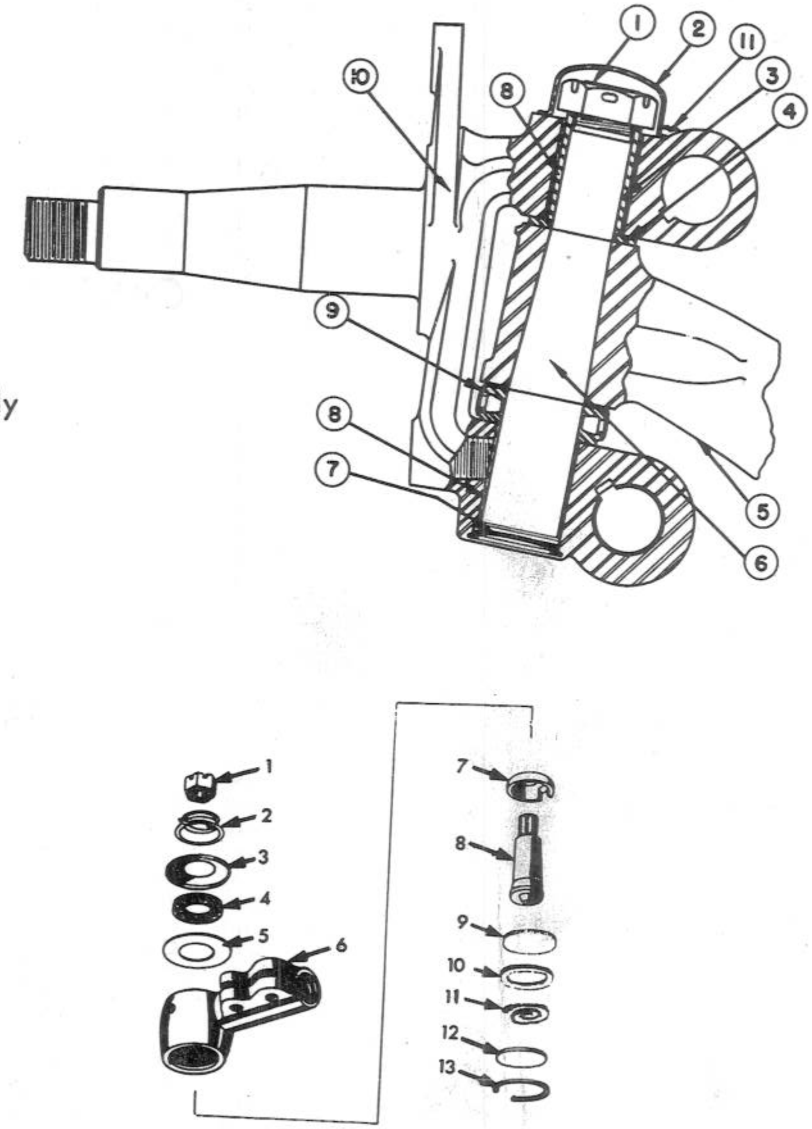
The front axle center is a steel forging, heat treated for toughness and resistance to bending and torsional strain. If the center is bent or twisted less than approximately 5 degrees from the original shape, it may be straightened. However, it is recommended that this work be done only by mechanics who are thoroughly familiar with such operations and where the proper facilities are available. Parts which are distorted more than approximately 5 degrees from the

FRONT WHEEL ALIGNMENT SPECIFICATIONS

Camber (B minus A) degrees	Right: Negative 1/4° ± 3/8° Left: Positive 1/4° ± 3/8°
King Pin Inclination (D) degrees (Loaded Axle)	Left: 6-1/4° *
(Loaded Axle)	Right: 6-3/4° *
Toe-In (J minus H)	1/16" plus or minus 1/16"
Caster Angle (N)	Positive 3° minus 0°, plus 1/4°
Drag Link Arm Center Ball Stud to Top of I-Beam (E)	8" plus or minus 1/8"
Top of Tie Rod Below Spring Seat (F)	1-1/4" plus or minus 1/8"
Tire Overhang (G)	approx. 3"
Wheel Track	79.60"
Steering Arm Ball To Axle Centerline	On C.L. plus or minus 1/8"

*-1/2° With Free or Unloaded Axle

1 - Nut
2 - Cover
3 - Bushing
4 - Shim
5 - Axle Center
6 - Knuckle Pin (King Pin)
7 - Expansion Plug
8 - Bushing
9 - Thrust Bearing
10 - Steering Knuckle Assembly
11 - Cap Screw



1 - Nut
2 - Spring
3 - Retainer
4 - Washer
5 - Dust Cover
6 - Body
7 - Bearing
8 - Stud
9 - Washer
10 - Stud Seat
11 - Spring
12 - Plug
13 - Lock Ring

THIS STYLE TIE ROD END IS EFFECTIVE ON COACHES FROM UNIT NO. 10001 TO 10521. COACHES EFFECTIVE WITH UNIT NO. 10521 HAVE THE NON-REPAIRABLE END.

Figure 1 - 1: Steering Knuckle & Tie Rod End

original shape must be replaced, since such distortion exceeds the elastic limit of the material causing fractures which may result in failure under ordinary operating conditions.

CAUTION: Never apply heat to a front axle forging. Front axle parts should be straightened cold only.

STEERING KNUCKLES

DESCRIPTION

For construction of the steering knuckles, refer to Figure 1 - 1. The steering knuckles may be removed from the axle without removing the axle assembly from the coach.

REMOVAL

To remove the steering knuckle, jack up the front end of the vehicle so the tires clear the floor. Block securely in this position and remove jacks. Do not attempt to disassemble or perform knuckle repair with the vehicle supported by jacks only.

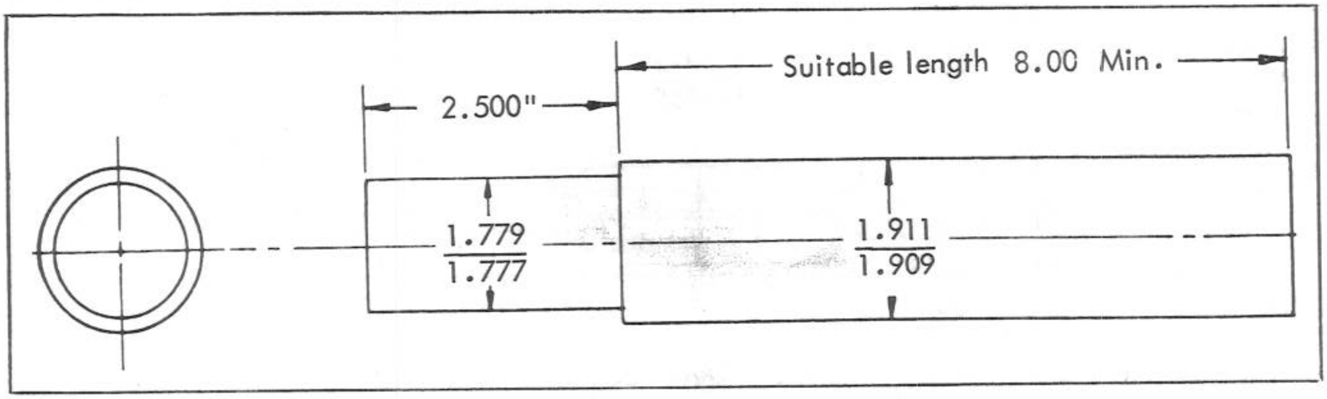


Figure 1 - 2: Bushing Removal & Installation Tool

Remove hub cap plate, wheel bearing adjusting nut, lock, lock dowel ring, and doweled nut assembly. Remove outer wheel bearing cone and wheel and hub assembly. Disconnect the tie-rod from the steering arm.

The tapered knuckle pins must be removed from the bottom side of the knuckle. Disconnect push rod and remove brake chamber. Remove the knuckle pin cover cap screws, cover and cover gasket. Remove the lock ring with a pair of snap ring pliers. Dislodge and remove the expansion plug with a drift. Drive knuckle pin out by using a bronze drift on the upper end. Remove the knuckle pin sleeve and lift off steering knuckle, thrust bearing and spacing washers.

REPAIR

Removal and replacement of bronze steering knuckle bushings should be done using the removal and installation tool shown in Figure 1 - 2. Such a tool can be made from a piece of round bar stock which is ground with a step to serve as a pilot.

Worn bushings are pressed out of the knuckle, employing the tool described. New bushings should be installed with the same tool. The pilot of this tool prevents collapse or distortion of the bushing during installation. The bushing should be pressed into the knuckle in three or more steps, using an arbor press, to allow it to align itself in the bore. First press the bushing into the knuckle approximately 1/8" and relieve press pressure. Then press the bushing in another 1/2" and relieve press pressure. The bushing can now be pressed in until it is flush with the inner machined surface of the knuckle. This applies to both upper and lower bushings.

To finish a bushing either a burnishing bar or reamer should be employed. Suitable reamers are illustrated in Figure 1 - 3. A burnishing ball should not be used for this operation, since it does not insure a true alignment between the two bushings.

The reamer has a removable pilot which is installed to ream the upper bushing. The pilot is then removed to ream the lower bushing.

Avoid the possibility of tapering or enlarging the upper bushing while inserting the tool to ream the lower bushing.

REASSEMBLY

Before reassembly, make sure that the knuckle pin hole in the axle center is clean and dry. Position and support the steering knuckle assembly on the axle center. Slide the thrust bearing between the lower surface of the axle center and the lower steering knuckle yoke. Thrust bearings should be positioned with the retainer lip down. Align the steering knuckle holes with axle center and thrust bearing holes. Place a jack under the lower side of steering knuckle yoke and raise the knuckle so that all clearance is taken up between the lower yoke, thrust bearing and lower face of the axle center. Clearance between the top face of the upper axle center end and lower face of upper knuckle pin boss should not exceed .015 in. Washers and shims are available in various thickness to take up this clearance and hold within the desired tolerance.

Make sure the knuckle pin nut turns on the threads. Insert the knuckle pin from the bottom yoke of knuckle and drive the pin into the seat of the axle center and by using a bronze drift. Place the steel knuckle pin sleeve over the pin and tap into place. Install nut and tighten to 350-390 ft. lbs. to draw the knuckle pin into the axle center. Then apply additional turn to line up with the next cotter pin hole. Do not back off.

For reassembly of brakes refer to Sec. 4, "Brakes and Air System" and Section 15, "Wheels, Hubs and Drums."

TIE ROD ENDS

DESCRIPTION

The tie rod assembly is of 3 piece construction comprised of a rod and two end assemblies. The tie-rod end automatically compensates for wear on bearing surfaces. The tie-rod end stud is held in contact with the bearing surface by tension of a

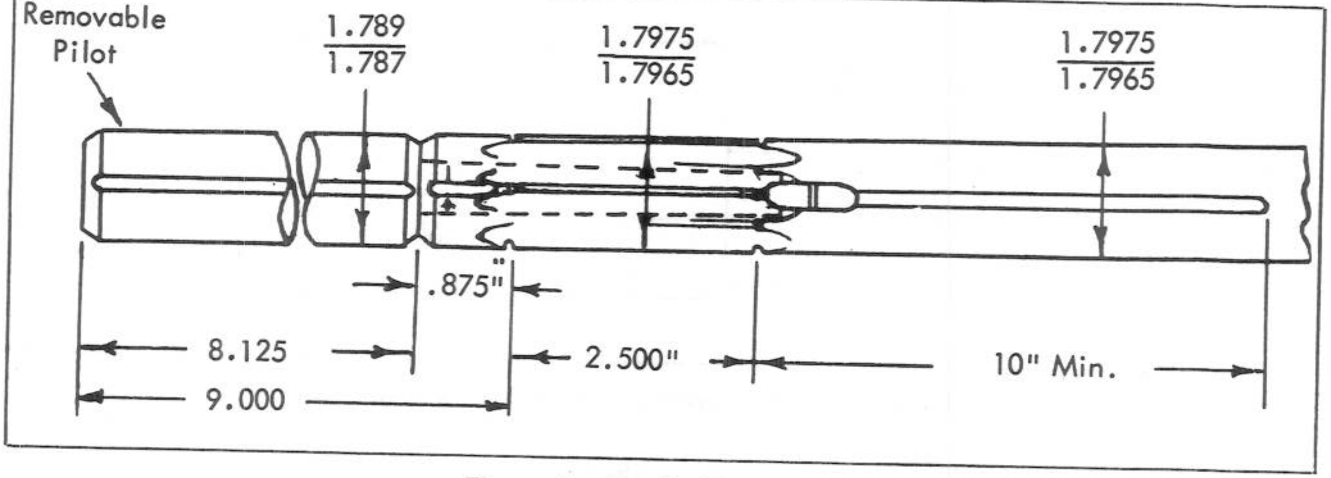


Figure 1 - 3: Bushing Reamer

spring which holds the seat firmly against the inner end of the stud. An end plug, retained by a locking ring, holds the internal tie-rod end parts in position. Excessive play indicates that the bearing surfaces are worn, and new tie-rod end assemblies should be installed.

REMOVAL AND REPLACEMENT

To remove tie-rod ends from the tie-rod assembly, remove cotter pins and nuts from the tie-rod ends, and support the steering arm to prevent bending. Using a small drift, drive the tie-rod end tapered stud out of the steering arm. Loosen clamp bolts and remove tie-rod ends from the tie-rod tube.

To reassemble, assemble the tie rod end on the tie-rod tube, but do not tighten clamp bolt. Insert the tie-rod end stud into the steering arm and tighten to 165-180 ft. lbs. Tighten clamp bolts.

DISASSEMBLY

Pry end plug lock out of groove in body. Remove plug, seat, and spring. Remove grease retainer. Stud and bearing assembly can then be removed from the tie-rod end body.

All worn parts should be replaced. Tension of the retaining spring should be checked, and the spring replaced if it does not have sufficient tension to hold the tie-rod end stud firmly against the bearing. A new grease retainer should be used.

REASSEMBLY

Lubricate parts with light grease before reassembly. Insert stud and bearing assembly into tie-rod end body, place grease retainer over end of end stud seat, and position seat in body. Place the retaining spring inside the seat, position end plug on spring, then compress spring and install end plug lock in groove.

(Before replacement of tie-rod on steering arm, clean tapered portion of tie-rod end stud.)

If appropriate facilities for repairing the serviceable tie-rods ends is not available, it is recommended that the non-repairable ends, Parts Nos. 1M-2-47 L.H. and 1M-2-48 R.H. be installed. It should also be noted that on coaches prior to Unit No. 10521, when replacing tie-rod end of the non-repairable type, the complete cross tube and end assembly Part No. 1F-2-3 must be installed. Tie rod ends and cross tubes are not interchangeable individually on coaches from Unit No. 10001 thru 10520 and on coaches from Unit No. 10521 and on.

PROCEDURE FOR CHECKING WEAR AT THE TIE ROD ENDS

Socket wear is indicated by ball stud turning torque and socket end movement. Zero turning torque with looseness in the ball stud is indicative of extreme wear. To check this, the socket must be removed from the vehicle. End movement may bechecked with the socket assembly attached to its mating arm. If a force, sufficient to overcome thespring pressure is applied to the end of the forging, the amount of movement is another indicator ofwear. The following may be used for the specified types of assemblies.

SOCKET TYPE			**END MOVEMENT**
		ORIGINAL	**WORN**
Old Style Serviceable Socket Assy.	1 C-2-21 L.H. 1 C-2-22 R.H.	.016-.020 L.H.	.090 Max. MC-7 Prior to Feb.-67
New Style Serviceable Socket Assy.	1 C-2-50 L.H. 1 C-2-51 R.H.	.020 Max.	.090 Max. MC-7 Eff. Feb. 67
New Style Non-Serviceable Socket Assy.	1M-2-47 L.H. 1M-2-48 R.H.	.002-.010	.060 Max. MC-7 with Unit 10521 and Current

SPECIFICATIONS

AXLE CENTER	
Type	I Beam
Allowable Twist (Variation between ends)	1/2°
STEERING KNUCKLES	
Spindle diameter: Inner Bearing	2.5623-2.5613 in.
Outer Bearing	2.1248-2.1243 in.
Up-and-down Movement, Maximum	.015 in.
Bushing bore, diameter	1.919-1.921 in.
STEERING KNUCKLE BUSHINGS	
Material	Bronze
Inside — Line ream	1.7935-1.7945 in.
Line burnish	1.7965-1.7975 in.
KING PIN	
Type	Tapered
Diameter — Large End	1.794-1.793 in.
Small End	1.3095-1.3085 in.

TORQUE SPECIFICATIONS

LOCATION	**DIAMETER**	**LB./FT.**
Tie-Rod End Nut	7/8"	165-180
Tie-Rod Clamp Bolt	5/8	55-65
Steering Arm Ball Nut	7/8"	165-180
Steering Arm Nut	1-1/8"	350-390
King Pin Nut	1-1/8"	350-390

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

REAR AXLE

DESCRIPTION

The single-reduction final drive employs a heavy duty drive pinion and drive gear (3.70 ratio Standard). The differential and gear assembly is mounted on tapered roller bearings.

The straddle-mounted pinion has two tapered roller bearings in front of the pinion teeth which take the forward and reverse thrust, and a third bearing behind the pinion teeth to carry the radial load.

MAINTENANCE

Lubrication recommendations will be found in Section 10 (Lubrication) of this manual.

To insure maximum life of the differential and prevent premature failure, the original "factory fill" lubricant should be drained before putting vehicle into regular service or prior to 3,000 miles.

During initial stages of normal operation, tiny metal particles are freed from mating surfaces of moving parts. These metal particles are carried by the lubricant through the assembly and act as lapping compound which accelerates wear of all parts.

Draining the factory lubricant prior to 3,000 miles also prevents lubricant contamination caused by differences in the "factory fill' and the lubricant used by the operator when topping.

REMOVAL AND REPLACEMENT

Refer to Section 12 (Suspension) of this manual for instructions for removal of the entire rear axle assembly as a unit.

DIFFERENTIAL CARRIER

Remove plug from bottom of axle housing and drain lubricant. Remove axle shaft drive stud nuts and lockwashers. Rap axle shaft sharply in center of flange with heavy steel hammer on drift to free dowels. Remove tapered dowels and axle shafts.

CAUTION: Prying shafts loose will damage the hubs and oil seals.

Remove carrier to housing stud nuts and washers. Loosen two top nuts and leave on studs to prevent carrier from falling. Break carrier loose from axle with rawhide mallet & puller screws.

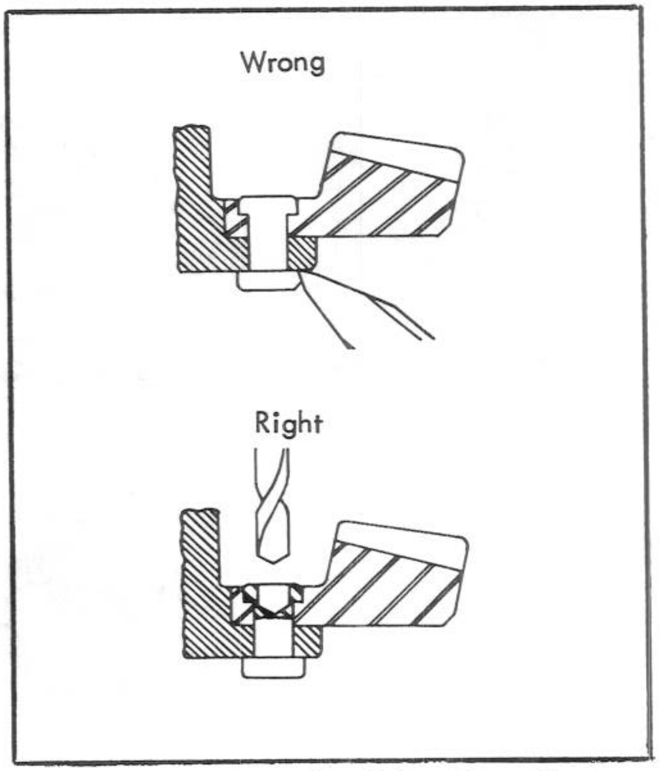


Fig. 2 - 1: Removing Drive Gear Rivets

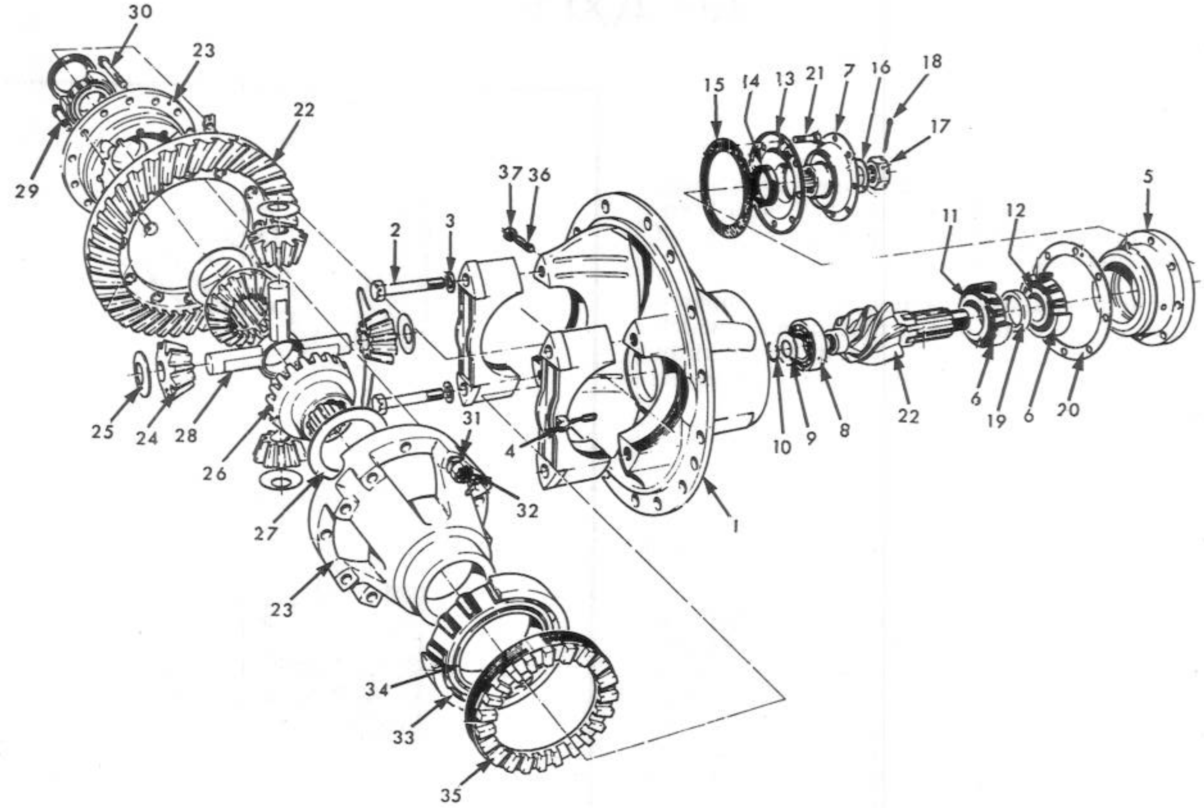
Remove top nuts and washers and work carrier free using puller screws in holes where provided. A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange. A roller jack may be used to facilitate removal of carrier.

DISASSEMBLY

Place carrier in suitable holding fixture. If the initial inspection indicates the drive gear is not going to be replaced, the established backlash should be measured and noted for reference for reassembly.

Differential And Gear Assembly Removal:

1. Loosen jam nut and back off thrust block adjusting screw. Center punch one differential carrier leg and bearing cap to identify for proper reassembling.
2. Cut lock wire, remove cap screws and adjusting nut locks. Remove bearing cap stud nuts or cap screws, bearing caps and adjusting nuts.
3. Lift out differential and gear assembly. Re-



1. Carrier, Cap & Plug Assembly
2. Capscrew
3. Washer
4. Adj. Ring Block Pin
5. Cage & Cup Assembly
6. Inner & Outer Cup
7. Companion Flange & Slinger Assembly
8. Bearing
9. Retainer
10. Lock Ring
11. Inner Bearing Cone
12. Outer Bearing Cone
13. Cover & Oil Seal Assembly
14. Oil Seal Assembly
15. Gasket
16. Washer
17. Nut
18. Cotter Pin
19. Spacers
20. Shims
21. Capscrew
22. Bevel Drive Gear & Pinion Assembly
23. Case Assembly
24. Differential Pinion Gear
25. Thrust Washer
26. Side Gear
27. Thrust Washer
28. Spider
29. Short Case Bolt
30. Long Case Bolt
31. Washers
32. Nut
33. Bearing Cup
34. Bearing Cone
35. Adjusting Ring
36. Drive Gear Thrust Screw
37. Thrust Gear Lock Nut

FIGURE 2 - 2: Differential Carrier Parts

move thrust block from inside of carrier housing.

Differential And Gear Disassembly:

1. If original identification marks are not clear, mark differential case halves with a punch or chisel for correct alignment on reassembling.

2. Cut lock wire, remove bolts and separate case halves.

3. Remove spider, pinions, side gears and thrust washers. If necessary, remove rivets and separate gear and case.

Ring Gear Removal:

1. Carefully center punch rivets in center of head. Use a 9/16" drill bit to drill through head. Press out rivets.

Pinion And Cage Assembly Removal:

2. With suitable tool, remove pinion shaft nut washer and companion flange. Remove pinion cage stud nuts or cap screws. Remove bearing cage using puller screws in holes where provided.

CAUTION: The use of a pinch bar will damage the shims. Driving pinion from inner end with a drift will damage the bearing lock ring groove.

3. Wire shim pack together to facilitate adjustment on reassembling.

Disassembling Pinion And Cage:

1. Tap shaft out of cage with mallet or press shaft from cage. Remove outer bearing from cage.

2. Remove spacer or spacer combination from pinion shaft. If necessary to replace rear thrust bearing or radial bearing, remove with suitable puller.

REPAIR

Thorough visual inspection for indications of wear or stress, and the replacement of such parts as are necessary will eliminate costly and avoidable drive unit failure.

Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers. They may easily mutilate or distort component parts.

Inspect hypoid gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. When necessary to replace either the drive pinion or drive gear of hypoid set, the entire gear set should be replaced.

Inspect the differential assembly for pitted, scored or worn thrust surfaces of differential case halves, thrust washers, spider trunnions and differential gears. Thrust washers must be replaced in sets. The use of a combination of old and new washers will result in premature failure.

Check the differential pinion and side gear teeth for wear or damage Always replace the differential pinions and side gears in sets.

Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

CLEANING

Parts having ground and polished surfaces such as gears, bearings, shafts and collars, should be cleaned in suitable solvent such as kerosene or diesel fuel.

CAUTION: Do not clean these parts in a hot solution tank or with water and alkaline solutions such as sodium hydroxide, orthosilicates or phosphates.

Steam cleaning assembled drive units after they have been removed from the housing is not recommended. When this method of cleaning is used, water is trapped in the cored passage of the castings and in the close clearances between parts as well as on the parts. This can lead to corrosion (rust) of critical parts of the assembly and the possibility of circulating rust particles in the lubricant. Premature failing of bearings, gears, and other parts can be caused by this practice. Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. Complete drive unit disassembly is a necessary requisite to thorough cleaning.

Rough parts such as differential carrier castings and cast brackets may be cleaned in hot solution tanks with mild alkali solutions providing these parts are not ground or polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. The parts should be thoroughly rinsed after cleaning to remove all traces of alkali. Completely assembled axles may be steam cleaned on the outside only, to facilitate initial removal and disassembly, providing all openings are closed. Breathers, vented shift units, and all other openings should be tightly covered or closed to prevent the possibility of water entering the assembly.

Parts should be thoroughly dried immediately after cleaning. Use soft, clean lintless absorbent towels or wiping rags free of abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

REASSEMBLY

Parts that have been cleaned, dried, inspected and are to be immediately reassembled, should be coated with light oil to prevent corrosion. If these parts are to be stored for any length of time, they should be treated with a good RUST PREVENTATIVE and wrapped in special paper or other material designed to prevent corrosion.

Replace all worn or damaged parts. Hex nuts with rounded corners, all lockwashers, oil seals and gaskets should be replaced at the time of overhaul. Remove nicks, mars and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. A fine mill file or India stone is suitable for this purpose. Studs must be tight prior to reassembling the parts. When assembling component parts use a press where possible.

Tighten all the nuts to the specified torque. (See torque limits following service instructions.) Use soft iron locking wire to prevent possibility of wire breakage.

The burrs, caused by lockwashers, at the spot face of stud holes of cages and covers should be removed to assure easy reassembly of these parts.

If new cups are to be installed, press firmly against pinion bearing cage shoulders. Lubricate bearings and cups with light machine oil. Press rear thrust and radial bearings firmly against the pinion shoulders with a suitable sleeve that will bear only on bearing inner race.

Install radial bearing lock ring and squeeze ring into pinion shaft groove with pliers. Insert pinion and bearing assembly in pinion cage and position spacer or spacer combination over pinion shaft. Press front bearing firmly against spacer. Rotate cage several revolutions to assure normal bearing contact.

While in press under pressure, check bearing preload torque. Wrap soft wire around cage and pull on horizontal line with pound scale. If a press is not available, the pinion nut may be tightened to the correct torque and preload checked. Nut torque required to obtain correct preload is 800-1100 ft.lbs. Use rotating torque, not starting torque. If rotating torque is not within 5 to 15 pound inches, use thinner spacer to increase or thicker spacer to decrease preload.

Install flange, washer and pinion shaft nut. Place pinion and cage assembly over carrier studs. Tighten pinion shaft nut to the correct torque. The flange must be held with a suitable tool or fixture to tighten nut.

Recheck pinion bearing preload torque. Tighten to the correct torque and install cotter key.

CAUTION: Do not back off nut to align cotter key holes.

Pinion And Cage Assembly Installation:

1. Install correct shim pack. Locate thin shims on both sides for maximum sealing ability.
2. Position pinion and cage assembly over studs and tap into position with soft mallet. Install lockwashers and stud nuts or cap screws. Tighten to correct torque.

Assembling Differential And Gear:

1. Rivet the hypoid gear to the case half with new rivets. Rivets should not be heated, but always upset cold. When the correct rivet is used, the head being formed will be at least 1/8" larger in diameter than the rivet hole. The head will then be approximately the same height as the preformed head. Excessive pressure will cause distortion of the case holes and result in gear eccentricity.
2. Differential case and gear bolts are available for service replacement of rivets. The use of proper bolts greatly facilitates servicing these units in the field and eliminates the need for special equipment necessary to correctly hold rivets.

Differential Pinion And Side Gear Assembly:

1. Position thrust washer and side gear in bevel gear and case half assembly.
2. Place spider with pinions and thrust washers in position. Install component side gear and thrust washer.
3. Align mating marks, position component case half and draw assembly together with four bolts or cap screws equally spaced.
4. Check assembly for free rotation of differential gears and correct if necessary. Install remaining bolts and cap screws, tighten to correct torque and lock wire.
5. If bearings are to be replaced, press squarely and firmly on differential case halves.

Differential And Gear Assembly Installation:

1. After checking related parts, coat the differential bearing cones and cups with specified rear axle lubricant.
2. Place the bearing cups over the assembled differential bearing cones, then position the differential assembly in the carrier.
3. Insert bearing adjusting nuts and turn hand-tight against bearing cups. Install bearing caps in the correct location as marked and tap lightly into position.

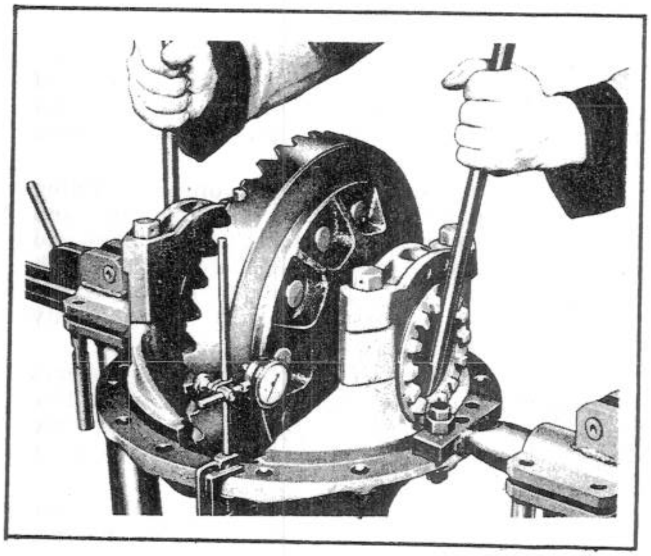


FIGURE 2 - 3: Differential Bearing Preload Adjustment

CAUTION: If bearing caps do not position properly, adjusting nuts may be cross threaded. Remove caps and reposition the adjusting nuts. Forcing caps into position will result in irreparable damage to the carrier housing or bearing caps.

4. Install flat washers and cap screws. Tighten cap screws to 470-595 ft. lbs. torque.

Installing Bearing Cups In Carrier Leg Bores:

1. Temporarily install the bearing cups. Tighten cap screws to proper torque.
2. Bearing cups must be of a hand push fit in the bores, otherwise the bores must be reworked with a scraper or emery cloth until a hand push fit is obtained.
3. Use a blued bearing cup as a gauge and check the fits as work progresses. Once the cups fit properly, remove the bearing caps.

BEARING PRELOAD ADJUSTMENT

Using dial indicator at backface of gear, loosen the bearing adjusting nut on the side opposite gear only, sufficient to notice end play on the indicator.

Check gear for runout. If runout exceeds .008", remove differential and check for cause. Tighten adjusting nuts one notch each from .000 end play to preload differential bearings.

HYPOID GEAR BACKLASH

If the drive gear is not going to be replaced, we suggest the established backlash recorded before disassembly be used. For new gears the new backlash should be initially set at .010". Adjust backlash by moving gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.

TOOTH CONTACT

Apply oiled red lead lightly to the hypoid gear teeth. When the pinion is rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts.

Sharper impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the gear teeth. Coast side should be automatically correct when drive side is correct. As a rule, coating about twelve teeth is sufficient for checking purposes.

After obtaining a satisfactory tooth contact, especially in relation to the top and bottom of the tooth, the backlash can be altered within the limits of .005" - .015" to obtain a better contact position relative to the length of the tooth.

A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.

BEVEL GEAR THRUST ADJ.

To secure correct clearance between adjusting screw and back face of bevel drive gear tighten screw firmly and back off 1/4 turn. The correct adjustment is .010" - .015" clearance. Recheck to assure minimum clearance of .010" during full rotation of bevel drive gear.

DRIVE UNIT

Remove any accumulation of dirt, grit or gum from housing bowl and sleeves. Clean housing thoroughly with solvent and blow dry with compressed air. Inspect housing for cracks, loose studs, nicks, and burrs at machine surfaces. Remove nicks and burrs with stone or file. Make all necessary repairs or parts replacement before installing drive unit in housing. Install new drive unit to housing gasket over housing studs.

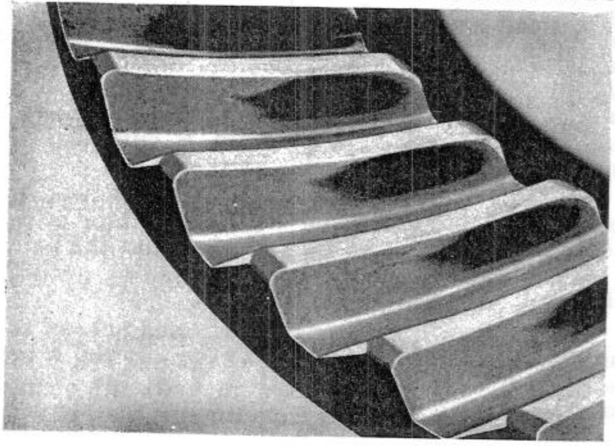
Roll the carrier into position on roller jack.

CAUTION: Do not drive carrier into housing with a hammer at the carrier stud flange. The flange may easily be distorted and cause severe oil leakage. Install lockwashers and stud nuts on any studs under carrier housing offsets. It is impossible to start these nuts after carrier is drawn into housing.

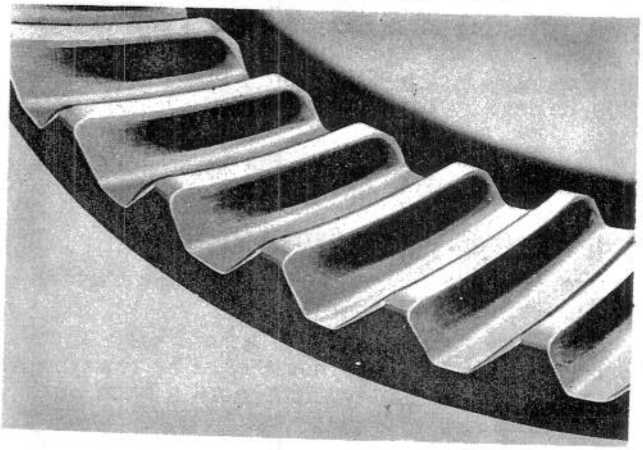
Start carrier into housing with four flat washers and nuts equally spaced.

Tighten the four nuts over flat washers alternately to draw carrier squarely into axle housing. If necessary, remove nuts and flat washers and install taper dowels, lockwashers and stud nuts. Tighten to the correct torque. Install axle shafts.

CORRECT TOOTH CONTACT ASSURES LONGER GEAR LIFE

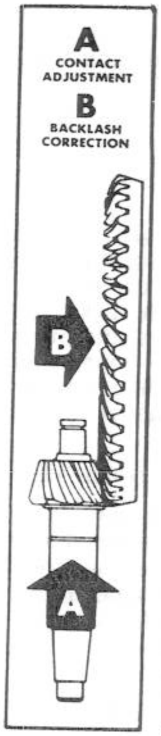


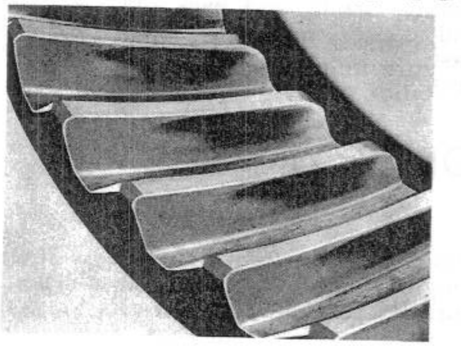
Satisfactory Tooth Contact (Gears Unloaded)



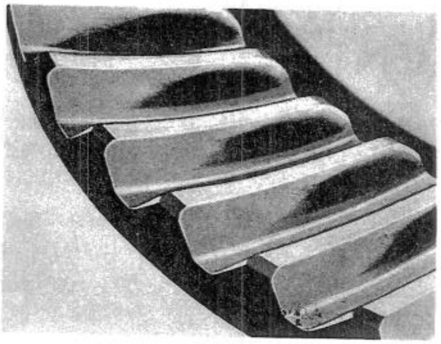
Satisfactory Tooth Contact (Gears Loaded)

INCORRECT TOOTH CONTACT

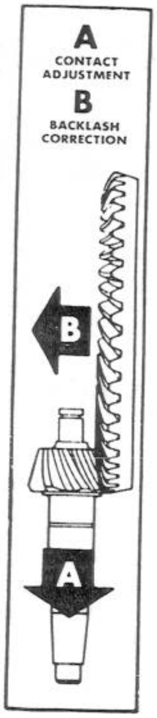




A HIGH NARROW CONTACT is not desirable. If gears are allowed to operate with an adjustment of this kind, noise, galling and rolling over of the top edges of the teeth will result. To obtain correct contact, move pinion toward gear to lower contact area to proper location. This adjustment will decrease backlash between pinion and gear teeth, which may be corrected by moving gear away from pinion.



A LOW NARROW CONTACT is not desirable. If gears are allowed to operate with an adjustment of this kind, galling, noise and grooving of teeth will result. To obtain correct contact, move pinion away from gear to raise contact area to proper location. Correct backlash of .005" to .015" may be obtained by moving gear toward pinion.



NOTE: The actual backlash changes approx. .008" for each .010" movement of the gear.

With adjustments properly made (pinion at correct depth and backlash set at .010") the above contacts will be procured. The area of contact favors the toe and is centered between the top and bottom of the tooth.

The hand rolled patterns (gears unloaded) will result in a pattern centered in the length of the tooth when the gears are under load. The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.

The pattern on the coast side of teeth will appear the same width as the drive side; however the over-all length will be centered between the toe and heel of gear tooth.

Set used hypoid gear to have the tooth contacts to match wear pattern. Hand rolled pattern of used gears will be smaller in area and should be at the toe end of wear patterns.

TABULATION OF TORQUE LIMITS

CAP SCREWS AND STUD NUTS

LOCATION	DIAMETER	NO. THREADS	TORQUE — LB. FT.	
			MIN.	MAX.
Pinion cage	3/8"	16	33	43
	1/2"	13	81	104
	9/16"	12	116	149
	5/8"	11	160	205
Carrier to housing	7/16"	14	53	67
	1/2"	20	81	104
	5/8"	18	160	205
	3/4"	16	290	370
Differential case bolt	1/2"	20	92	118
	9/16"	18	130	167
	5/8"	18	185	235
	3/4"	16	320	415
Pinion shaft	7/8"	20	175	250
	1"	20	300	400
	1 1/4"	18	700	900
	1 1/2"	18	800	1100
	1 1/2"	12	800	1100
	1 3/4"	12	800	1100
	2"	12	800	1100
Differential bearing adjusting nut lock	5/16"	18	16	20
	1/2"	13	75	96

DIFFERENTIAL BEARING CAP CAP SCREWS OR STUD NUTS

(Later Axle Models Employing Hardened Washers)

CAP SCREW OR STUD NUT DIAMETER	CAP SCREW OR COARSE STUD THREAD	STUD NUT OR FINE THREAD	TORQUE — LB. FT.	
			MIN.	MAX.
5/8"	11	18	160	205
3/4"	10	16	290	370
7/8"	9	14	470	595
7/8"	14	14	510	655
1"	14	14	580	745

Torques given apply to parts coated with machine oil; for dry (or "as received") parts increase torques 10%; for parts coated with multi-purpose gear oil decrease torques 10%. Nuts on studs to use same torque as for driving the stud.

BODY

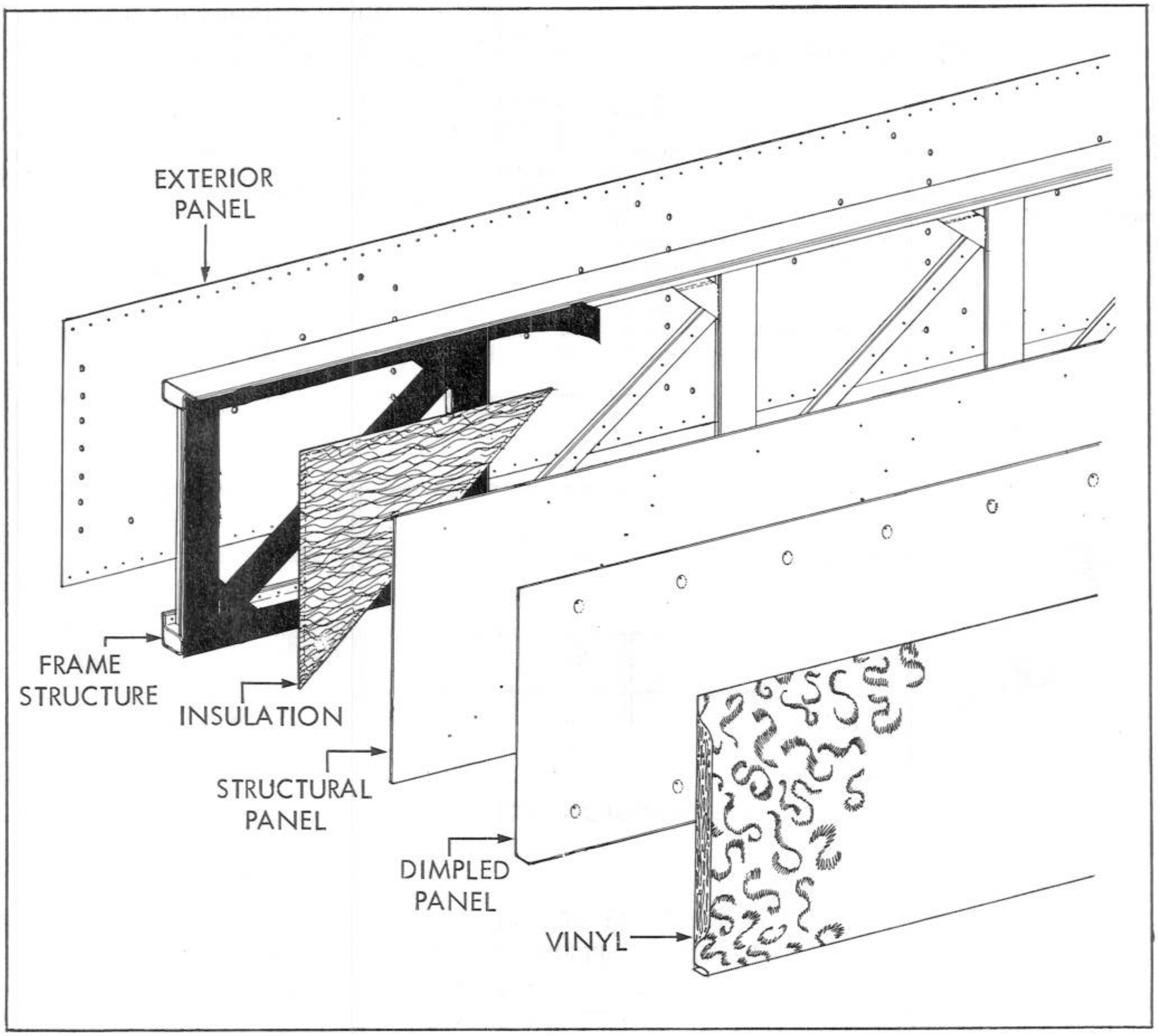
SIDEWALL CONSTRUCTION

Construction of the coach sidewalls is shown in Figure below. The sidewall consists of a welded steel framework with a stainless steel or aluminum exterior panel, on aluminum structural inner panel and a second dimpled interior panel. The space between the interior structural and dimpled panels serves as a duct for the heating and air conditioning systems.

Panels are riveted to the frame structure. Presstite is used to separate panels from the steel framework.

DESCRIPTION

Body construction is integral "monocoque" type, using fabricated alloy and stainless steel structural members, the latter at points in contact with road splash. The structure is welded together into a strong, lightweight unit properly reinforced at points of stress. Interior and exterior panelling, floor and bulkheads are rivetted to the framework.



SIDEWALL CONSTRUCTION

Exterior panelling below the windows is a combination of anodized aluminum and stainless steel for sustained appearance, minimum maintenance, and resistance to corrosion. Exterior trim sections and mouldings are stainless steel and anodized aluminum.

Waterproof plywood for the passenger floor is secured to the framework and rubber flooring applied.

Interior panelling is covered in vinyl and melamine finished materials for appearance and minimum maintenance. Ceiling panels are outlined with stainless steel moulding. Sidewalls below windows are padded, insulated and covered in vinyl material.

Ribbed rubber floor tread is used in the center aisle, stepwell and driver's area. Flat rubber flooring is used under passenger seats.

EXTERIOR MAINTENANCE

Regular washing to remove accumulated dust and dirt is recommended. This is all that is required on the exterior stainless steel panels below the windows. The panel caps between the windows are anodized aluminum. This is a hard abrasion resistant anodic coating which is produced by an electrochemical process. Avoid the use of alkaline cleaners on aluminum parts as they will attack and corrode aluminum just as iron and steel will rust. Use only a mild detergent and a soft brush. Abrasive cleaners, polish, or steelwool should not be used as they will remove the protective coating and may scratch and discolor the finish.

The entire under side of the coach is sprayed with a heavy coat of asphalt base deadener.

UPHOLSTERY MAINTENANCE

Once every month all upholstery should be vacuumed. Every four months the upholstery, after vacuuming, should be washed or dry cleaned. (Washing or dry cleaning twice a year should be considered a minimum.)

Upholstery fabrics must be kept clean if maximum service is to be expected. Vacuuming is all that is necessary for a long period and the most economical and effective method to wash upholstery is through use of either a neutral (non-alkaline) soap or an approved foam-type cleaner.

The word "washing" should not be misinterpreted. By washing, it is not meant you should soak the fabric. The objective is to loosen the greasy bond between the fabrics and the dirt they have picked up. While it will not harm the upholstery to become thoroughly wet, it will take longer for it to dry before the equipment can go back onto service. Foam-type cleaners are preferred because of the short time required for drying.

COACH JACKING POINTS

When it is necessary to raise the vehicle by using jacks under body members instead of under

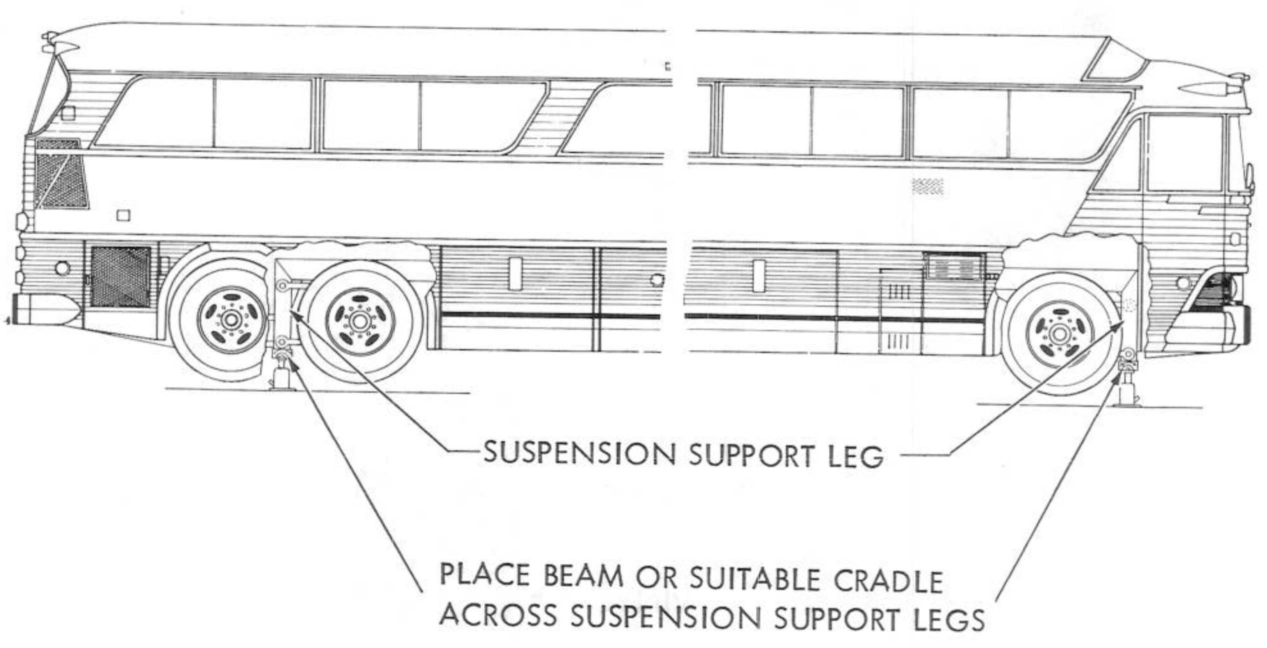

SUSPENSION SUPPORT LEG
PLACE BEAM OR SUITABLE CRADLE ACROSS SUSPENSION SUPPORT LEGS

FIGURE 3-1: Coach Jacking Points

axles, care should be taken to ensure that pressure is applied only at the point indicated in Figure 3 - 1. Otherwise distortion or damage may result to body sections.

INSTRUCTIONS FOR TOWING

Two hooks are provided at the front of the vehicle for towing purposes, attached to the tire compartment trusses which, in turn, are welded to the front bogie legs. **Towing should be done from these points only.**

NOTE: Front bumper must be in "open" position while coach is being towed.

It is strongly recommended when towing a coach that a solid type link be used between the towing vehicle and coach.

CAUTION: Do not use tow hooks for lifting front end of coach.

SAFETY PRECAUTION: It is also recommended that a safety chain be attached between towing vehicle and coach. The safety chain must be attached across suspension support and under axle of coach. Do not tie safety chain around the centre part of axle I-beam.

BODY REPAIRS

RIVETING

There are a number of types of rivets used in the manufacture of the coach and a general classification of these types as follows:

1. 55 ST. used on baggage floors, trusses, side paneling, where strength is required and the rivet can be reached for bucking.

2. 2SF — used on baggage doors — strength not too critical and can be reached for squeezing.

4. AD-43-BS — U.S.M.C. "Pop" rivets on all other inaccessible points or accessible places where ease of installation is required.

5. Cherry Rivets:

CR763W-6-8
CR763W-6-16
CR763W-8-6
CR763W-8-10
CR2249-6-3
CR2249-6-5
CCR73M-6-4
CCR73M-6-6

These are used where strength is required and the rivet is not readily reached for bucking. Hand type guns for pulling up Cherry Rivets and Lazy Tongs for Imex and "Pop" are available for repair work. Contact M.C.I. Service Parts department for particulars.

Repairing and replacement of body parts will require removal of rivets. Rivets can be removed by cutting off the rivet head with a sharp chisel, or by drilling out rivet with a drill slightly smaller than body of rivet. A rivet with a large head, first cut a groove across center of rivet head with a cape chisel then cut off with a flat chisel.

RIVETING TOOLS

The following riveting tools are recommended for field body repairs in Challenger coaches:

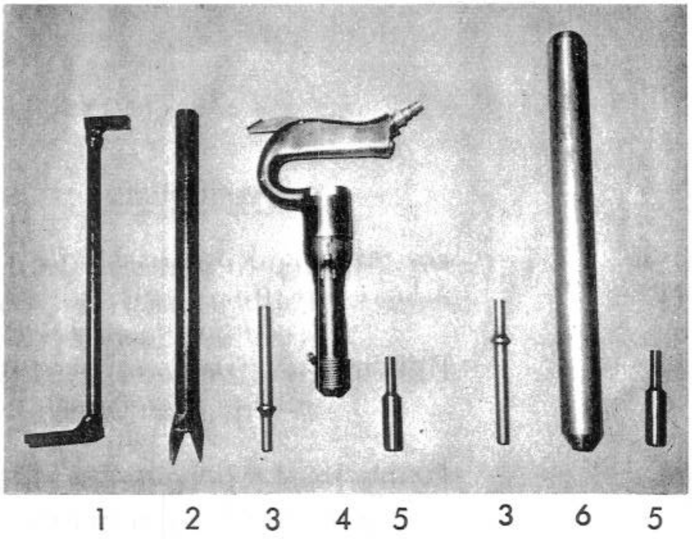


Figure 1

Key No.	Qty.	Part No.	Description
	1	3C-33-35	Riveting Kit Assembly (MCI)
(1)	1	T & D 5-1245	Rivet Bucking Foot (MCI)
(2)	1	T & D 5-1244	Holding Fork - For elevator floor bolts (MCI)
(3)	2	T & D 5-1247	Rivet Set - Brazier head, 5/32",
(4)	1	N.P.N.	Riveting Gun - Pistol grip, CP-4X, Aero, Chicago Pneumatic
(5)	2	T & D 5-1248	Rivet Set - Brazier head, 7/32" (MCI)
(6)	1	T & D 5-1246	Dolly - Bucking, Tool Holder

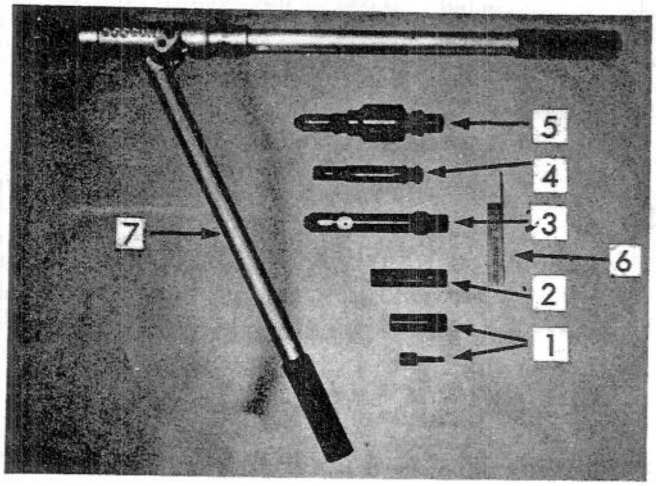


Figure 2

Photo Key No.	Part No.	Description
	3C-33-36	Cherry Riveting Kit Assembly (M.C.I.)
(1)	N.P.N.	Adapter - Pulling head, No. 226, for Cherry rivet hand gun No. G55
(2)	N.P.N.	Pulling Head - Universal head H908U, for 1/4" Cherry High Clinch rivets: 763W-8-6 763W-8-10
(3)	N.P.N.	Pulling Head - Universal head H577A6U, for 3/16" plugged Cherry monel rivets: CCR73M-6-4 CCR73M-6-6

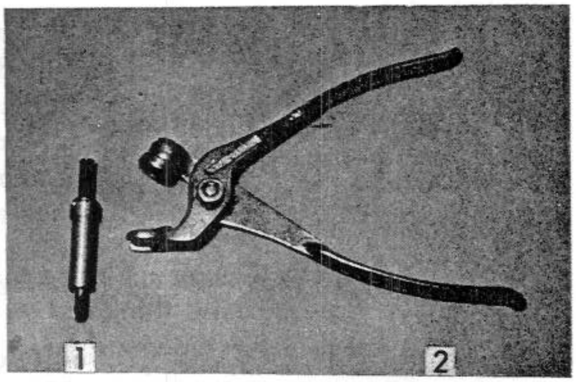


Figure 4

Photo Key No.	Part No.	Description
	3C-33-38	Panel Clamping Kit Assembly (M.C.I.)
(1)	N.P.N.	Clamp - Wedge lock, 1/4", Aviation Devices, 12 per kit. Used to hold panels in place.
(2)	N.P.N.	Pliers - Wedge lock, for applying clamp, 107M

WELDING

The entire frame structure is of welded design. Self contained suspension bogeys for the front and rear are jig welded to ensure proper alignment of the main radius rod attaching points.

The pressure-tight air reservoirs are an integral part of the bogey. Care should be exercised that no cutting or drilling be done on the two horizontal air reservoirs at the front and two at the rear.

All the lower parts of the framework from the main floor to the skirt rail are manufactured from stainless steel. This prevents rust and corrosion attack on the frame members, due to moisture and road salts.

Repair of these sections can be carried out in the conventional manner.

WELDING ROD RECOMMENDATIONS

The following welding rods should be used when making welded repair to the body structure:

APPLICATION	DIAM.	A.W.S.
Stn. Stl. to Stn. Stl. or Corten, Light Ga.	3/32"	#308
Stn. Stl. to Stn. Stl. or Corten, Heavy Ga.	1/8"-5/32"	#308
Corten to Corten, Light Ga.	3/32"-1/8"	#6011
Corten to Corten, Heavy Ga.	3/32"-5/32"	#7018
Air beams, Reservoirs, Heavy Plate Sections	5/32"	#7018

REPAIR OF FIBREGLASS PARTS

All repairs to fibreglass parts consist of filling the damaged area with fibreglass cloth and resin or strand fibreglass and resin. The repair is allowed to harden and then the finishing operations are performed. Use of the various materials is determined by the type of repair to be made. Large holes, torn sections and separate joints require the adhesive qualities of the resin and the reinforcing qualities of the fibreglass. Small dents, scratches or pits can be repaired using resin and strand fibreglass and filler mixed into paste. Instructions for either mix are explained later under respective headings.

(4)	N.P.N.	Pulling Head - Universal head H806U, for 3/16" High Clinch rivet: 763W-6-8 (knob stem must be cut with saw or nippers). Use No. 226 adapter on G55 hand gun.
(5)	N.P.N.	Pulling Head - Universal head H640B6U, for 3/16" Bulbed Cherrylock rivet 2249-6-3 with serrated stem
(6)	N.P.N.	Selector Gauge - Cherry rivet, for determining material thickness and proper grip length.
(7)	N.P.N.	Hand Gun - Cherry rivet, No. G55
(Not shown)	N.P.N.	Power Stem Saw - No. 301B, for trimming aluminum, mild steel and monel self-plugging Cherry rivets.

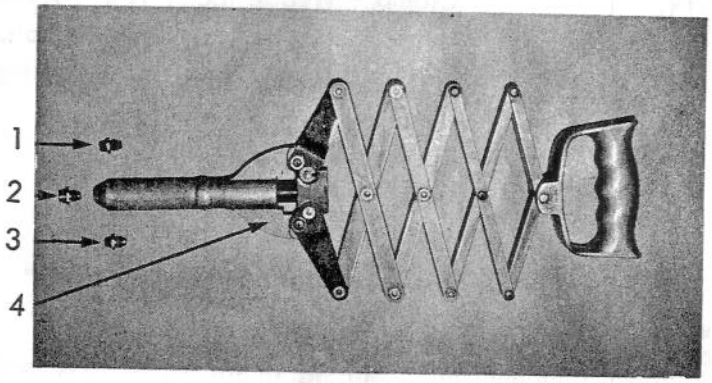


Figure 3

Photo Key No.	Part No.	Description
	3C-33-37	"POP" Riveting Kit Assembly (M.C.I.)
(1)	N.P.N.	Rivet Tip - Closed end, 13085C6, for 3/16" "POP" Imex rivets
(2)	N.P.N.	Rivet Tip - Open End, 13033C6, for 3/16" "POP" Monel rivets
(3)	N.P.N.	Rivet Tip - Open end, 13033C4, "B" for 1/8" monel "POP" rivets
(4)	N.P.N.	Hand Gun - Lazy Tong, TT4, for "POP" rivets. Use jaw No. 13027

For best results the ambient temperature should be 70° to 75°F, when making repairs. Some people experience a skin reaction to resins. When, and if this happens, wipe off skin with denatured alcohol or a good thinner. There are several protective hand creams on the market and use of one of these creams is recommended.

If any disc grinding or sanding is to be done in an enclosed area, a respirator should be used. Goggles should also be worn whenever grinding or sanding is done.

Extreme care must be taken if the sander is electrically operated as dust of some resins is combustible when subjected to sparks or open flame. The proper tool for sanding resin is a low speed, air driven disc sander with a water attachment or a dry sander having a vacuum bag attachment. Either will eliminate flying glass and resin dust.

The following additional tools and materials will assist in making repairs. Hacksaw blade, assorted files emery paper or cloth (No. 150 grit or finer), scissors or tin snips, wax paper or cellophane sheets, small 3" paint roller, paint brush, putty knife, acetone, and one or more heat lamps.

PROCEDURE FOR USING FIBREGLASS CLOTH

Where necessary, sand paint away around damaged area. On underside of coach, scrape away undercoating from damaged area and wipe clean with solvent.

Grind or file the damaged area to form a "V" at the broken or cracked portion. Sides of "V" should have a shallow pitch for maximum bonding area. NOTE: Roughening the surface improves adhesion of resin.

If paneling is warped from original shape, use "C" clamps and improvised clamp plates to align surfaces. Preheat area to be repaired using one or two heat lamps positioned 12 to 15 inches from repair.

CAUTION 200° F is the high limit for this material and to go higher is to risk material distortion or crystalizing.

Cut fibreglass cloth with scissors or tin snips one to three inches larger than area to be repaired. Build up area to desired height.

Mix desired quantity of resin and hardener in proportions of half a tablespoon of M.E.K. catalyst hardener to one quart of vibrin 135 resin. Do not use wax cups for mixing and do not allow resin to enter hardener can or vice-versa. Mixture which is too thin can be thickened to desired consistency by adding powdered filler. Two tablespoons of filler to one-half pint of mix will usually supply desired consistency

Saturate layers of fibreglass with mixture then place laminates over damaged area. Smooth out wrinkles and make sure general contour of area is maintained. Bubbles and wrinkles can be rolled out using a roller.

CAUTION: Once the resin and hardener have been mixed the pot.-life (working time) of the mix is approximately 15 minutes. Any accidental contamination to the skin, clothing, tools, etc., must be removed within this period. Use acetone to remove uncured resin.

Heat resin material again placing lamps 12 to 15 inches from repaired area. Allow 12 to 15 minutes for repair to cure. After repair is cured, grind, file or sand to contour. Files other than body files may be more suitable. Feather edge and finish sanding.

After making repair, small pits or irregularities may appear in finished surfaces. Imperfections should be repaired using a liberal amount of chopped strand or filler mixed with resin to form a paste. See "Procedure Using Fibreglass Paste".

REPAIR PROCEDURE USING FIBREGLASS PASTE

Fibreglass paste is used for repairing small dents, scratches, and pits. Paste is made by mixing resin, hardener and fibreglass strand or filler to the consistency of putty.

Where necessary, sand paint away around damaged area. On underside of coach, scrape away undercoating from damaged area and wipe clean with solvent.

Preheat the area to be repaired using heat lamps. Mix desired quantity of resin and hardener (Refer to Manufacturer's instructions on container.) Add powdered fibreglass strand into mixture to thicken it into a putty state.

CAUTION If repair is to be made on a vertical surface, adding of powdered filler material to mixture will reduce tendency of hot resin to flow or run.

Apply the material with a putty knife or similar object, building material up to desired contour. For deep filling and on vertical surfaces several layers of material may be used.

A hack-saw blade held flat to adjacent contour and then pulled, using sawing action across repair when the resin is in the jell stage, will remove excess resin from repair.

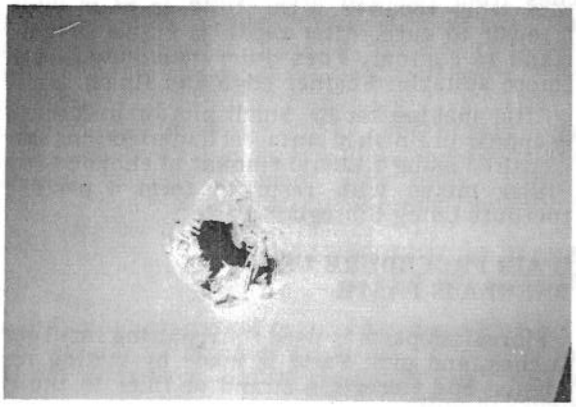
Finish repair in the same manner as when using fibreglass cloth.

PROCEDURE FOR PAINTING FIBREGLASS FRONT ROOF PANEL

DESCRIPTION

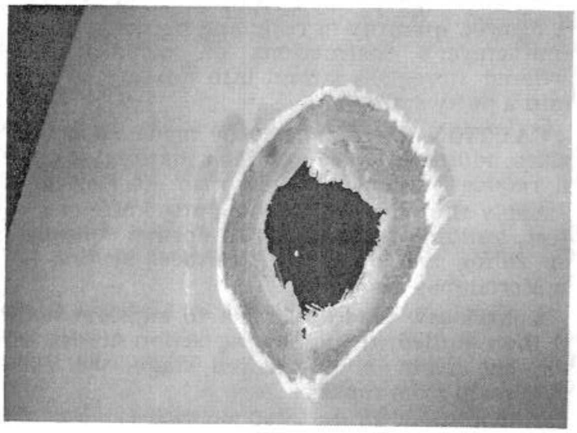
Wet sand with #320 wet or dry sandpaper using either losol or equivalent as the wetting agent. Sand with short strokes so as not to miss any areas, then wipe off with any of the above solvents. Fibreglass sealer #118-M-700 (3 Parts), Catalyst #118-M-700C (1 Part) (both are normally supplied together). Add catalyst to sealer, let stand one half hour or more before spraying one normal coat on fibreglass. **NOTE:** Allow two hours of drying time (minimum), sand using fine (400 grit) sandpaper before top or final coat, either air dry enamel or Amerflint.

TYPICAL VIEWS OF FIBREGLASS REPAIRS



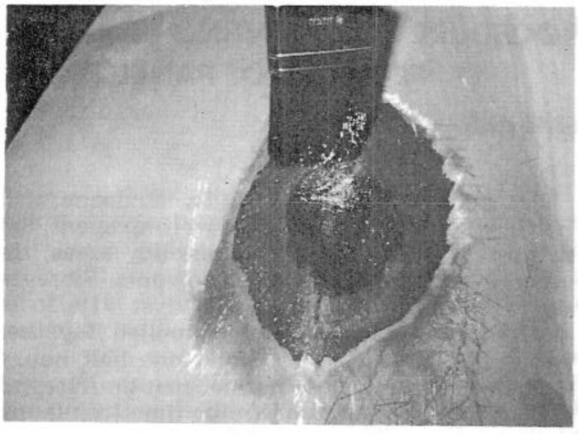
Area to be repaired.

VIEW A



Remove all loose particles of damaged material using a power sander or rasp clean area, overlapping hole approx. 1"-1½" all around. Remove all dirt, grease and paint from area to ensure good bonding surface. Feather the cleaned area all around.

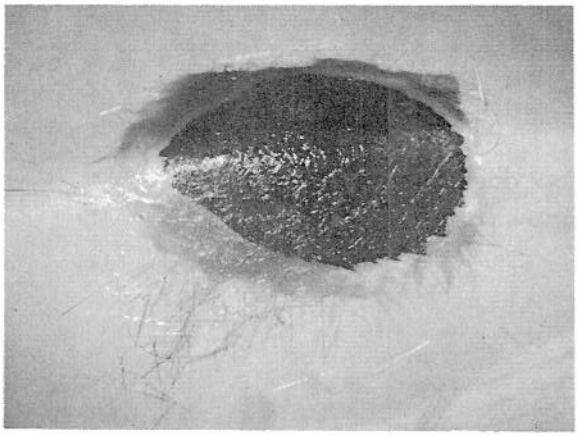
VIEW B



Cut a piece of fibreglass mat slightly larger than area being repaired. Impregnate mat with general purpose Polyester Resin - catalized normally. Use a clean paint brush to apply the Polyester Resin. Apply impregnated mat over hole and press onto surface with brush to obtain good adherance. Another coat of general purpose Polyester Resin can be applied at this time. NOTE:Be sure all air is removed from between surfaces being joined. Allow area to harden, when hard, sand surface to remove any wax.

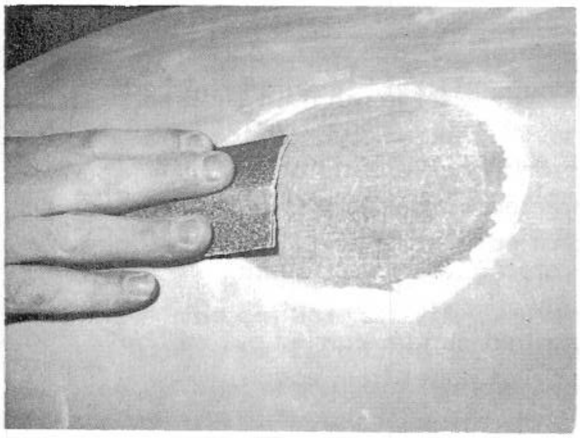
VIEW C

TYPICAL VIEWS OF FIBREGLASS REPAIRS (Cont'd)



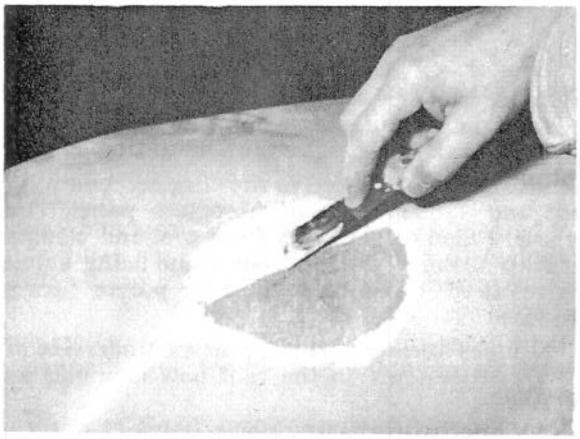
Apply another mat, follow with a cloth patch and then another mat, these layers must be thoroughly impregnated with the Polyester-Resin brushed well in ensuring at the same time that all air is removed from between the layers. Apply more layers of mat and cloth if required until the required strength and thickness is obtained. (Minimum: two 1½ oz. mat and one 9 oz. cloth). Allow area to harden. Allow sufficient time for patch to cool off properly before proceeding with next step.

VIEW D



Sand off area to the contour required, using coarse sandpaper #100.

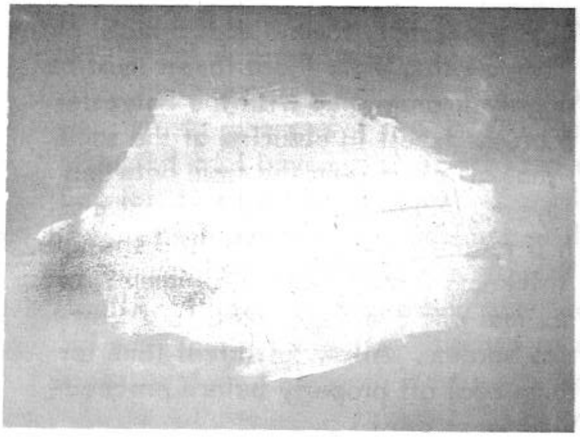
VIEW E



Apply a layer of Resin Putty.

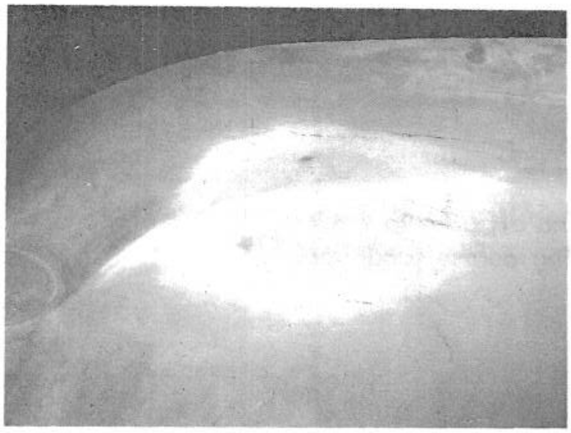
VIEW F

TYPICAL VIEWS OF FIBREGLASS REPAIRS (Cont'd)



Allow damaged area to dry for approx. 15 to 20 minutes.

VIEW G



Smooth off surface with coarse sandpaper #100 to required finished shape. Further smooth surface with fine sandpaper #120 to obtain completed surface to match surrounding area of paneling. Re-prime and repaint the area to match surrounding paintwork. NOTE: The rep airs described can be carried out without removing panel from coach.

VIEW H

RECOMMENDED PROCEDURE FOR INSTALLATION OF COMPLETE PANEL

DESCRIPTION

Should replacement of new fibreglass panel assembly be required, it is recommended that the panel be fitted to the roof section and marked from the underside in areas where roof bows are located.

NOTE: If roof bow channels are bent or damaged, they should be altered or replaced to match the contours of the fibreglass panel. It is also recommended that some areas may require shims. The location and required thickness of shim should be marked for necessary additions.

The panel should then be removed and sanded at marked areas to roughen the mounting surfaces. Dolphinite sealer is applied to the channel mounting surface and sanded area of fibreglass panel. The panel is installed to the lower front roof and clamps are applied to hold panel to roof frame using shims where required. Check the panel for proper fitting in all areas.

Drill holes through panel from the underside of channel, using holes in the roof bow channels as a template.

CAUTION: Drill four to five holes at one time and rivet.

NOTE: Use only 3/16 alum. Domed Head closed end pop rivets Part No. AD66H for rivetting. Do not attempt to drill all holes and then rivet. Before rivetting each hole, check to make sure misalignment and gapping does not take place.

PAINTING ALUMINUM PARTS

It is essential that a thorough cleaning process be instituted. Any commercial aluminum de-greaser may be used.

It is recommended that the old paint be completely removed by an organic solvent. Do not use alkaline paint remover on aluminum as it will subject the aluminum to severe corrosion. If there is no evidence of corrosion of an old primer, it may be left on, but all loose paint should be removed.

When the above steps have been taken, apply a 5% potassium dichromate or sodium dichromate solution in a warm condition to the cleaned surfaces. The mixture in this solution should be two ounces dichromate in one quart of water.

Spray on primer. An oil primer is recommended as this type of paint is used in the original production of the vehicle. However, it is permissible to use a reputable zinc chromate primer or under extreme circumstances a red oxide primer. Apply finish coats.

It may be noted at this time that should it be necessary to replace or repair underbody struction, that a metal deadener be applied over a prime surface.

PAINTING STEEL PARTS

The procedure outlined previously may also be used for steel and iron parts with the exception that both organic and alkaline paint removers may be used on steel parts. If alkaline removers are used, all traces of the alkaline must be removed before priming is applied.

Oil or oxide type primer is recommended rather than zinc chromate. If zinc chromate primer is used, then the surface must be roughened.

PAINTING STAINLESS STEEL PARTS

The following procedure is recommended for painting stainless steel exterior area of the coach:

First sand the area to be painted using 220 wet or dry sandpaper. Hand sanding is recommended.

Wash with a good grade of lacquer thinner. Apply one coat of zinc chromate primer (C-I-L 4703 or equivalent).

Apply one coat of enamel primer (C-I-L 4700-2 or equivalent).

Then apply finish enamel of the desired color.

PAINTING NEW PARTS

If sheet metal parts are purchased from M.C.I. Service Parts Division, they will be forwarded in a primed condition. It is then only necessary to apply finish coats as outlined.

REPAIR OF VINYL COVERED PANELS

1. Remove existing damaged vinyl covering from metal panel.
2. Thorough cleaning of the panel is essential. Use a Toluene cleaning fluid.
3. Apply a coat of #1368 3M contact cement to panel and bottom side of vinyl.
   Allow cement to dry until tack-free before applying vinyl to panel.
   NOTE: Cement must be sprayed on smoothly. If spraying equipment is not available, the cement can be brushed on, however application must be thin, uniform and smooth.

REPLACEMENT OF FLOOR COVERING

1. Remove existing damaged floor covering from wood floor.
2. Thorough cleaning of the floor is essential. Wire brushing or sanding methods are recommended.
3. Remove all sanding dust and other foreign matter. Floor must be clean before applying adhesive.
4. a. Under passenger seats, apply a coat of Dominion #55 Lino adhesive to plywood floor. Lino covering can be applied immediately.
   b. On center aisle, driver's area and entrance area, apply a coat of Dominion #61 Lino adhesive. Lino covering can be applied immediately.

UNDERSTRUCTURE CORROSION PREVENTION

DESCRIPTION

It is important to prevent excessive corrosion to coach underbody parts. Periodically clean the understructure to remove "dirt packs" from flanges, channels and ledges. These places accumulate dirt and salt and hold it in direct contact with steel and aluminum surfaces. Use an understructure spray as part of a regular and occasionally more thorough cleaning with a high pressure spray.

If underbody parts show evidence of rust or corrosion, treat as follows:

(1) Clean, remove dirt, grease and oil by solvent washing.

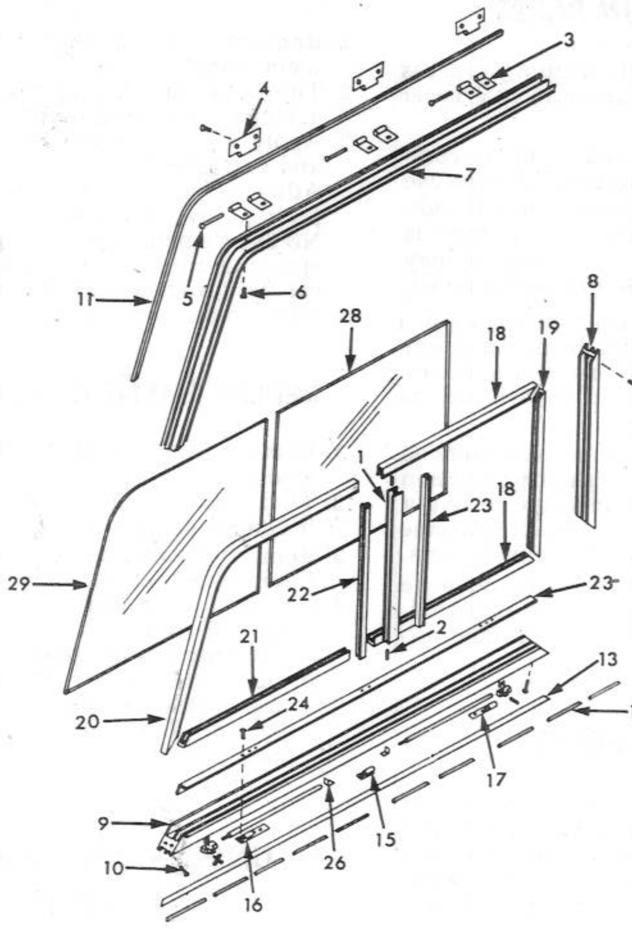
(2) Remove corrosion as well as all loose deadener coating by sanding with wire brush or with other means.

NOTE: If available, sandblasting can be used for cleaning bulkheads, brackets and other structural members, however, it should not be used for exterior side panelling. Extreme care should be taken not to sandblast excessively. Spray or apply a suitable underbody deadener coating.

SASH

SIDE WINDOW SASH

All side passenger windows can be opened from



No.	Part
1.	Center Mullion
2.	Screw
3.	Lower Hinge Leaf
4.	Upper Hinge Leaf
5.	Hinge Pin
6.	Hinge Rivet
7.	Top Frame Rail
8.	Side Frame Rail
9.	Bottom Frame Rail
10.	Corner Screw
11.	Top Rubber Seal
12.	Side Rubber Seal
13.	Bottom Rubber Seal
14.	Nylon Spacer
15.	Release Bar Keeper
16.	Release Bar Keeper
17.	Release Bar Keeper
18.	Top & Bottom Glazing Rubber
19.	Side Glazing Rubber
20.	Top Glazing Rubber
21.	Bottom Glazing Rubber
22.	Mullion Glazing Rubber
23.	Filler Strip
24.	Rivet
26.	Stop Angle
28.	Glass Unit
29.	Glass Unit

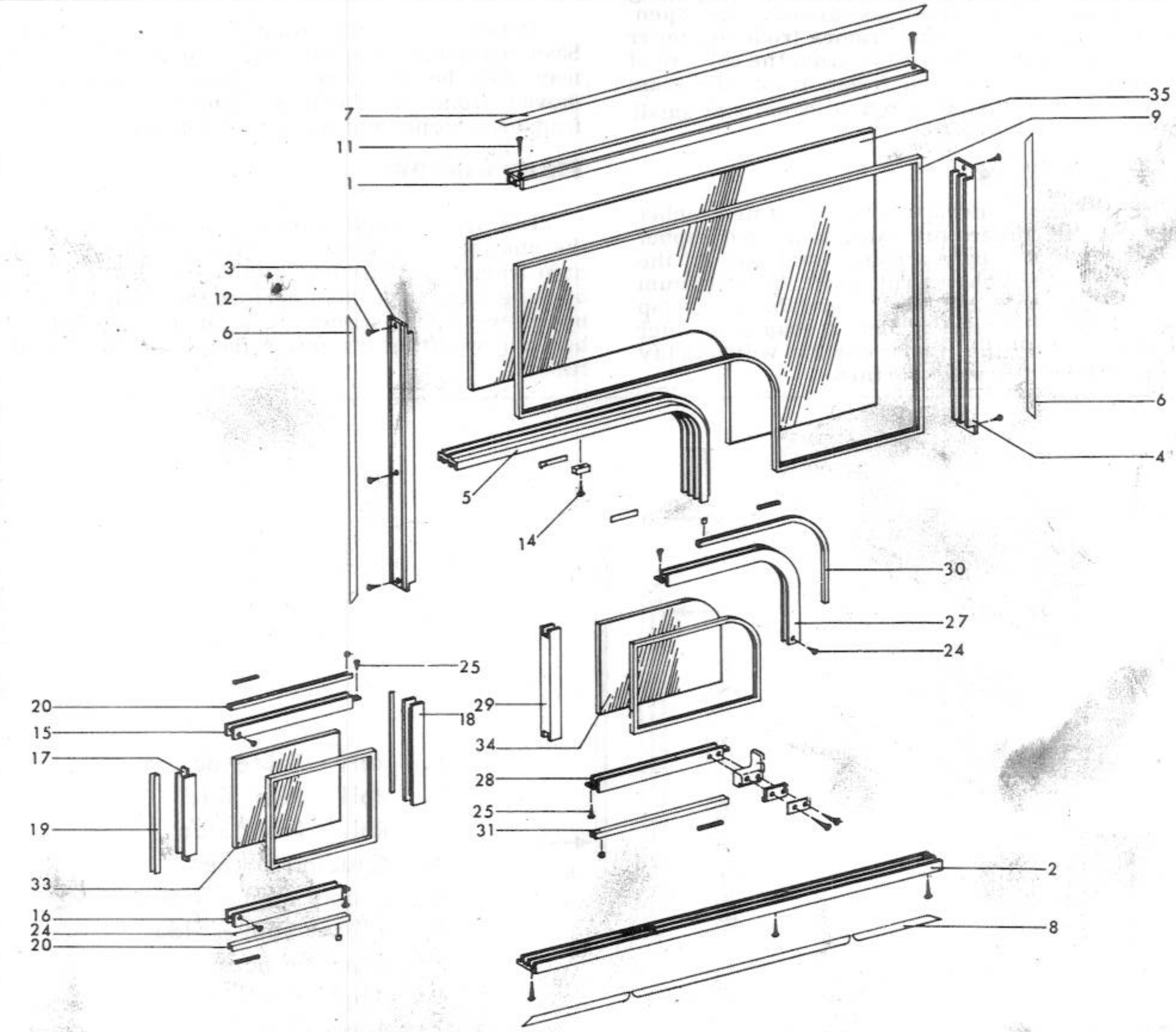
FIGURE 3 - 2: Side Sash Construction

the inside for emergency escape purposes. Window sash is hinged at the top and can be opened by pulling out and up on the lower moulding, then pushing window sash out. Instruction plates are mounted below the sash at each seat location.

Some coaches are equipped with an optional safety release mechanism having a secondary cord to prevent the window from swinging fully open accidentally; in these cases the cord must be pulled down after the release bar has been unlocked to fully open the sash.

TO REMOVE SASH

Side window is readily removed after first opening window to emergency release position. Remove



1. Top Rail
2. Bottom Rail
3. Rear Side Rail
4. Front Side Rail
5. Curved Rail
6. Rubber Seal
7. Top Rubber Seal
8. Bottom Rubber Seal
9. Top Glazing Rubber
11. Screw
12. Screw
14. Screw
15. Top Rail
16. Bottom Rail
17. Side Rail
18. Side Rail
19. Side Weatherstrip
20. Top & Bottom Weatherstrip
24. Screw
25. Screw
27. Curved Rail
28. Bottom Rail
29. Side Rail
30. Curved Weatherstrip
31. Bottom Weatherstrip
33. Glass
34. Glass
35. Glass

FIGURE 3 - 3: Driver's Window Construction

screws from end of each hinge pin, then remove pins from hinges. Push out at top of sash and lower window assembly from opening.

TO REMOVE GLASS FROM SASH

Remove the screws from the centre tie bar. Push the forward sliding sash back tc the opening stop and push the rear sliding sash ahead to the opening stop. Spring the sliding frames from the outer sash frame. Remove the screws from the corners of the sliding frame. Tap the frame from the glass using a wooden mallet or block of wood and small hammer.

TO REPLACE GLASS

Place rubber channel around glass. If new rubber is used, cut the corners the same as the old rubber that was removed. Apply a mastic sealer to all the corners where the rubber is cut. Place the aluminum frame sections over the glass and rubber and tap them in place with a soft mallet. A soap and water solution applied on the rubber channel will simplify assembly. Screw the frame together.

REAR CENTER WINDOW SASH

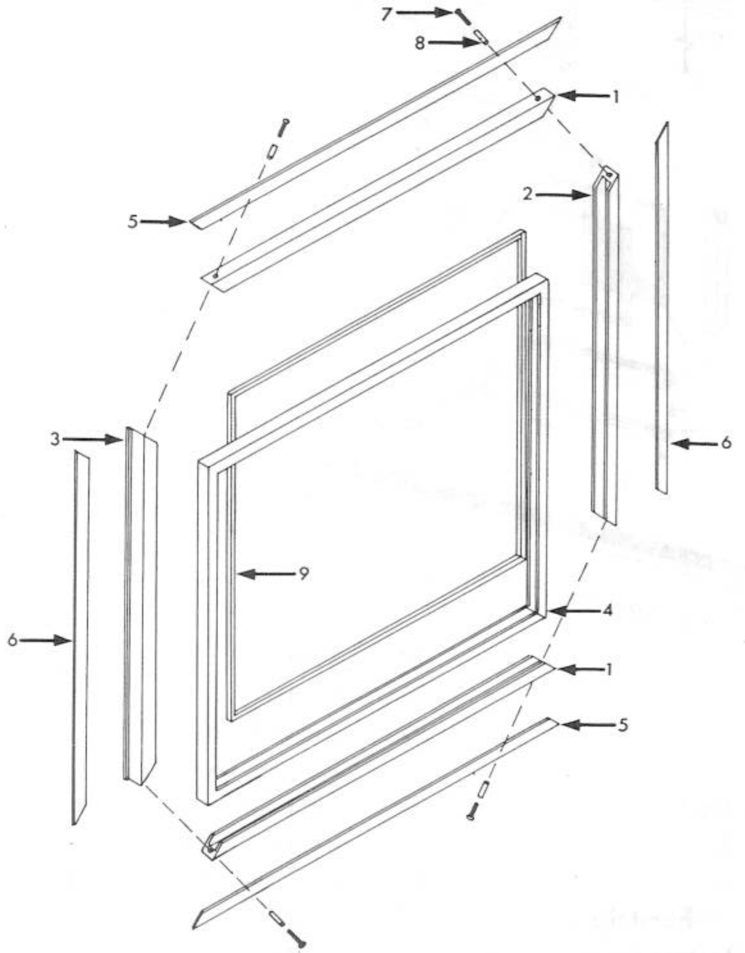
This is also a push-out type sash and is hinged at the top and latched at the bottom by spring latches mounted on a tubular release bar. Lift up on release bar to open sash and push out.

TO REMOVE ENTIRE SASH ASSEMBLY

Remove screws attaching hinge retainer to body. Sash assembly complete with hinge and retainer may then be removed. The glass unit may be removed from the frame by removing the screws from each corner and separating the frame.

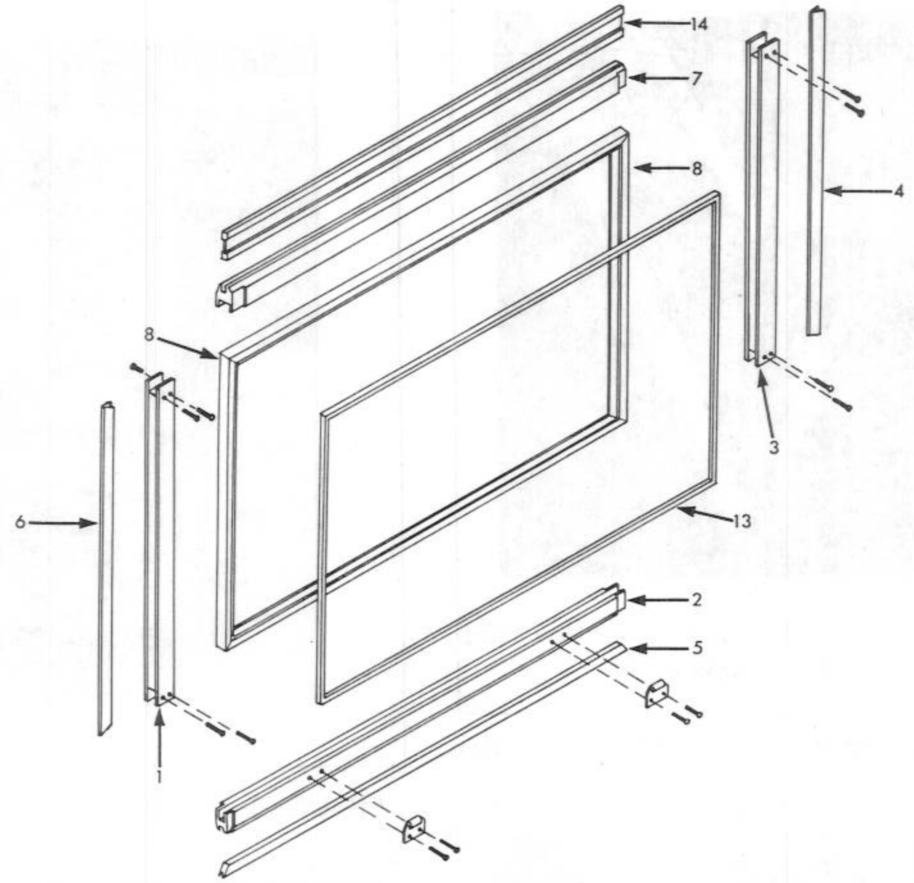
FIXED WINDOWS

The side triangle window, driver's window & the entrance door window are mounted in an aluminum frame, and this frame is screwed to the body opening flange and held against the sealing rubber by screws. These screws are located inside and can be seen by lifting the inside flange on the sealing rubber.



1. Rail - Top & Bottom
2. Rail - Rear Side
3. Rail - Front Side
4. Glazing Rubber
5. Rubber Seal - Top & Bottom
6. Rubber Seal - Sides
7. Machine Screw
8. Alignment Pin
9. Glass Unit

FIGURE 3 - 4: Entrance Door Window Construction



1. Side Rail - R.H.
2. Bottom Rail
3. Side Rail - L.H.
4. Rubber Seal - Side - L.H.
5. Rubber Seal - Bottom
6. Rubber Seal - Side - R.H.
7. Rail - Top
8. Glazing Rubber
13. Glass Unit
14. Rubber Hinge

FIGURE 3 - 5: Rear Center Window Construction

WINDSHIELDS

The windshields are laced directly to a flange around the opening by means of a grey rubber extrusion and rubber filler strip. A smaller section of similar rubber seal is also used around the destination sign glass.

BAGGAGE DOORS

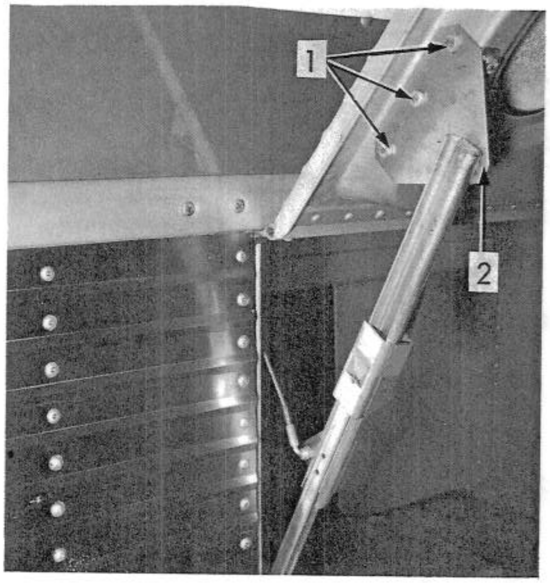
(Effective Unit No. 10001 thru 10500)

DESCRIPTION

Baggage compartment doors are rubber hinged lift-type. Mechanical door props are provided to hold door open. Fastened to the bottom of the baggage doors is a two-piece seal consisting of a feather edge (Inside flap) and a rubber seal. The doors incorporate flush-type latch locks. Each latch is flush mounted in the center at the lower portion of each door. To open, insert fingers under operating latch, then pull out and up. To close, hold door in closed position with operating latch in open or outward position, release and push down on latch to secure door.

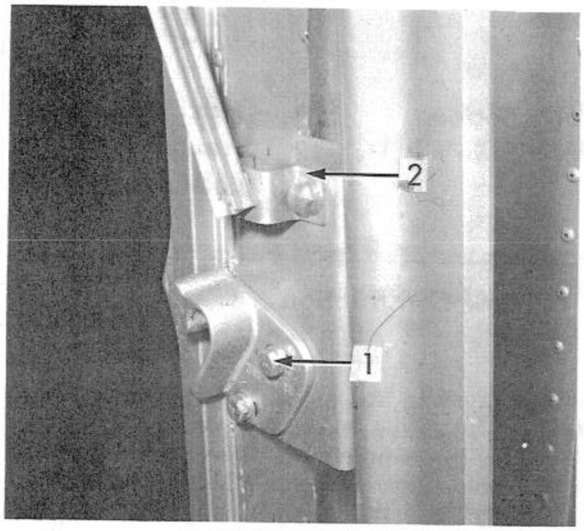
A counter-balance mechanism is employed to reduce effort required to open door. A cable and spring attached to the door prop offsets the weight of the door. This allows it to swing open to approximately half-open position upon release of the control handle.

Adjustment to latch mechanism to regulate door-to-body seal tightness can be made in the following manner.



1. Capscrews - $\frac{1}{4}$ - 20 x 3/4 N.C. Hex HD.
2. Prop & Door Mtg. Bracket S/A

FIGURE 3 - 6: Bagg. Door Prop Upper Section



1. Capscrew - 5/16 - 18 x 3/4 N.C. Hex. HD.
2. Prop Mtg. Bracket S/A.

FIGURE 3 - 7: Bagg. Door Prop Lower Section

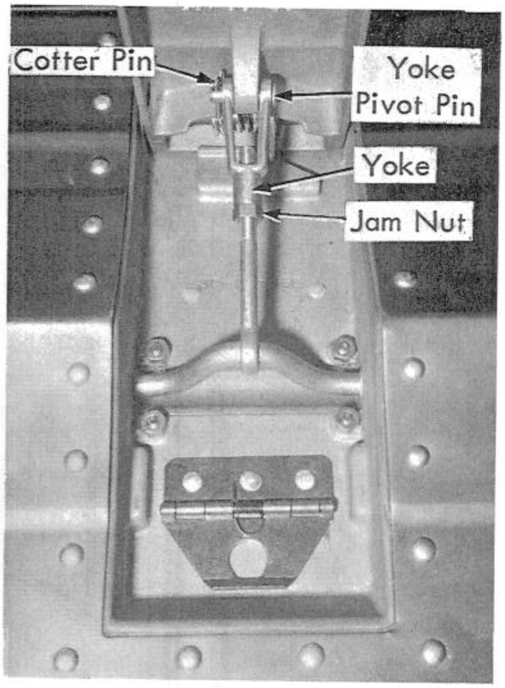
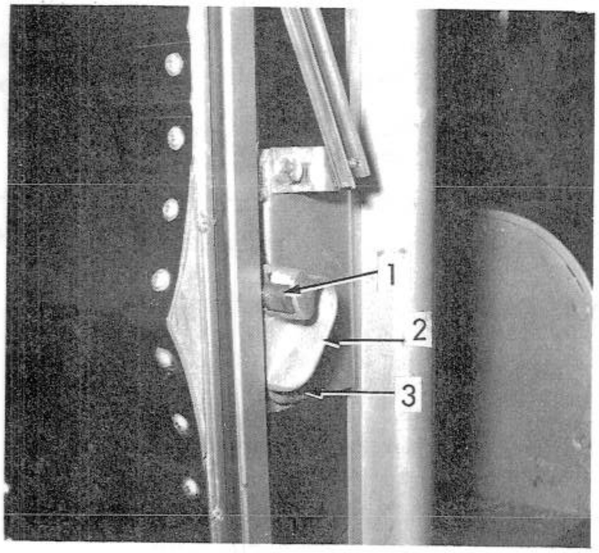
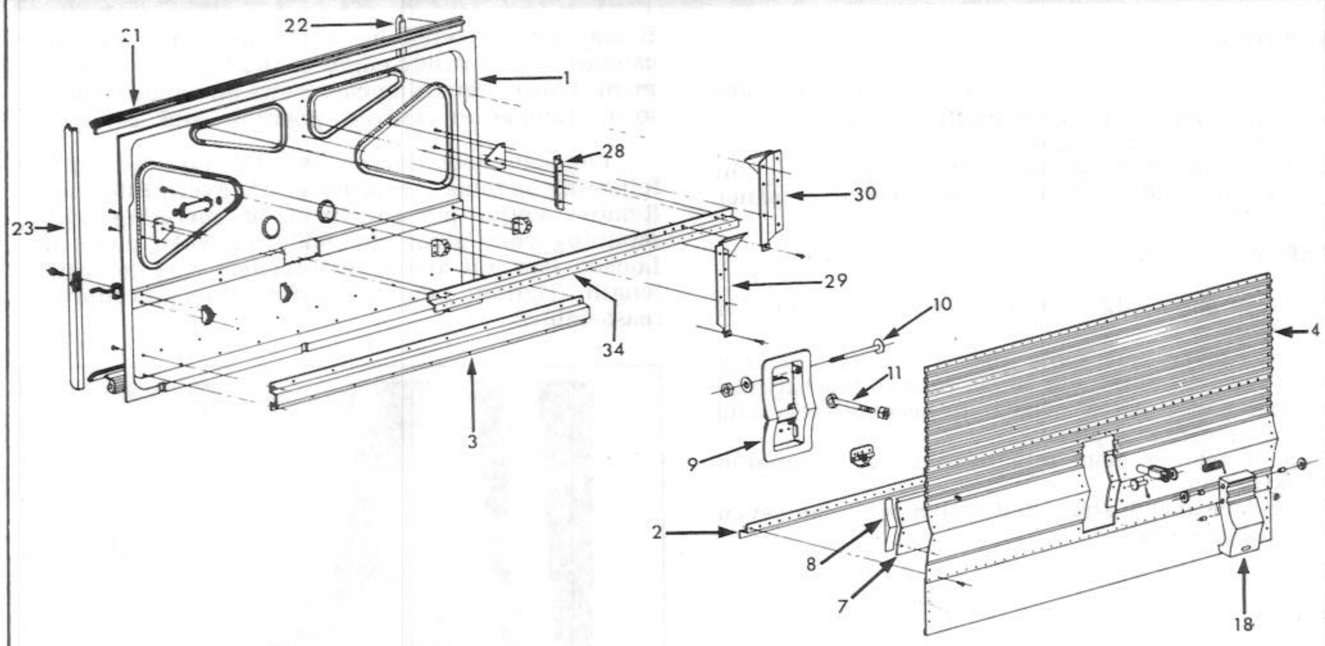


FIGURE 3 - 8: Bagg. Door Control Handle



1. Rubber Bumper
2. Striker Casting
3. Capscrew

FIGURE 3 - 9: Bagg. Door Lock Catch



1.	Inner Panel
2.	Center Z-Channel
3.	Lower U-Channel
4.	Outer Panel
7.	Panel - Reinf. Rub Rail
8.	Casting - Closing Rub Rail
9.	Box - Door Handle
10.	Pin & Washer S/A
11.	Rod
18.	Handle S/A
21.	Retainer
22.	Angle - R.H. Front & L.H. Rear
23.	Angle - L.H. Front & R.H. Rear
28.	Z-Channel - Center Vertical
29.	Z-Channel S/A - L.H. Upper
30.	Z-Channel S/A - R.H. Upper
34.	Z-Channel - Horizontal Center

FIGURE 3 - 10: Baggage Door Assembly
(Effective Unit No. 10001 thru 10500)

DOOR REMOVAL

1. Open door and remove screw at both ends fastening hinge retainer to hinge.
2. Slide front door toward front of coach and rear door toward rear of coach off rubber door hinge. To remove center door, remove either front or rear door then slide center door off rubber door hinge.
3. Slacken belt molding in vicinity of door by loosening screws. Remove screws at both ends of rubber hinge fastening hinge to belt rail molding.
4. Pull hinge out through milled opening between the doors.

INSTALLATION

To install, reverse the procedure. Use a vegetable oil to lubricate if necessary.

ADJUSTMENT

Refer to Figure 3-8. If baggage door locks too tightly and pinches seals at either front or rear, or locks too loosely, it may be corrected by adjusting the catches on the inside edges of the baggage compartment. Loosen the two retaining capscrews and slide catches to the desired position and retighten.

Baggage door lock may be adjusted in the following manner:

1. Remove cotter pin (on inside of operating latch) retaining yoke pivot pin.
2. Slide out yoke pivot pin.
3. Loosen jam nut and turn threaded yoke to desired length.
4. Tighten jam nut and reverse procedure to reassemble.

MAINTENANCE

To replace baggage door seals follow these steps:

REMOVAL

1. Remove metal strip between feather edge and seal by removing seven Phillips screws.
2. Slide out feather edge.
3. Seal can then be removed by loosening the cement holding it to the baggage door panel.

REPLACEMENT

1. Clean panel edge and apply a coat of EC-711 cement.
2. On rubber seal apply coat of C-1700 cement to the side which will be fastened to the baggage door panel. Allow cement to become tacky and then position in place.
3. Slide feather edge into position on aluminum extrusion.
4. Replace metal strap and fasten with the seven Phillips screws.

BAGGAGE DOORS

(PANTOGRAPH TYPE)

(Effective Unit No. 10501 etc.)

DESCRIPTION

Baggage doors are of the pantograph type. Doors lift out and up parallel to the side of coach and are held in open position by a spring type clip.

Baggage doors incorporate a flush-type latch locks, flush mounted at top of each door. Insert fingers under latch, then pull outward and up to unlatch door. To close, hold latch in open position, pull downward on door and push down on latch to secure door.

REMOVAL

Open door to half-open position, remove screws retaining hinge panel at door side. Open door to full position engaging hinge tube into spring clips. At this position remove lock rod hearing blocks. The door is now separated from coach body and can be removed.

CAUTION: Removal of door should be handled by more than one person.

INSTALLATIONI

To install, reverse the procedure.

ADJUSTMENTS

If baggage doors lock too tightly and pinch seals at either top or bottom, or lock too loosely, it may be corrected by adjusting upper or lower catches on the inside edges of the baggage compartment. Loosen retaining capscrews and slide upper or lower catches to desired position and retighten.

Baggage door locks may be adjusted in the following manner to provide an over-center lock. Remove cotter pin (on inside of operating latch), retaining yoke pivot pin. Slide out yoke pivot pin. Loosen jam nut and turn threaded yoke to desired length. Tighten jam nut and reverse procedure to reassemble.

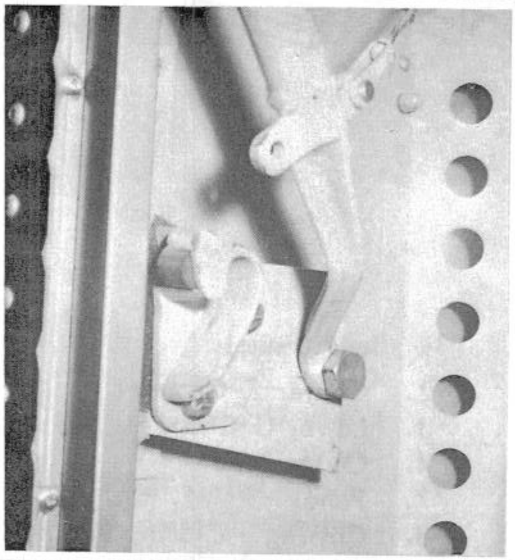


FIGURE 3 - 11: Upper Bagg. Door Catch

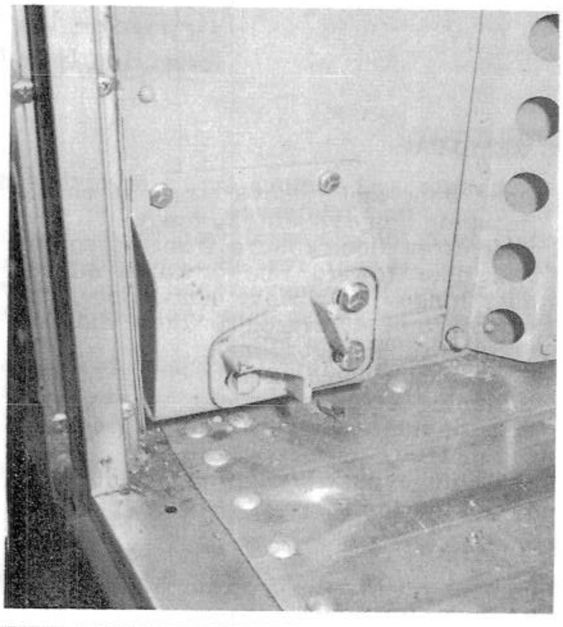
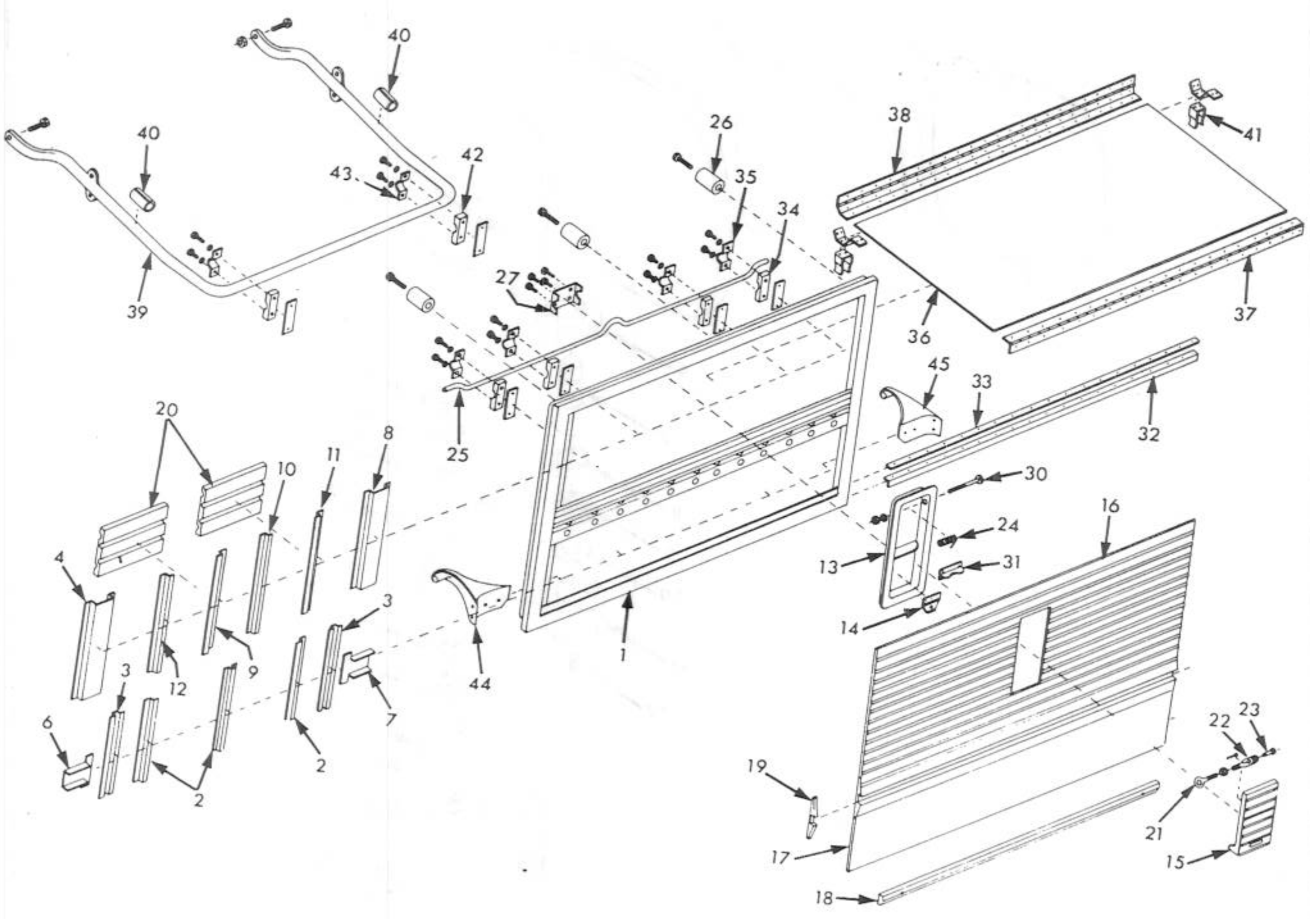


FIGURE 3 - 12: Lower Bagg. Door Catch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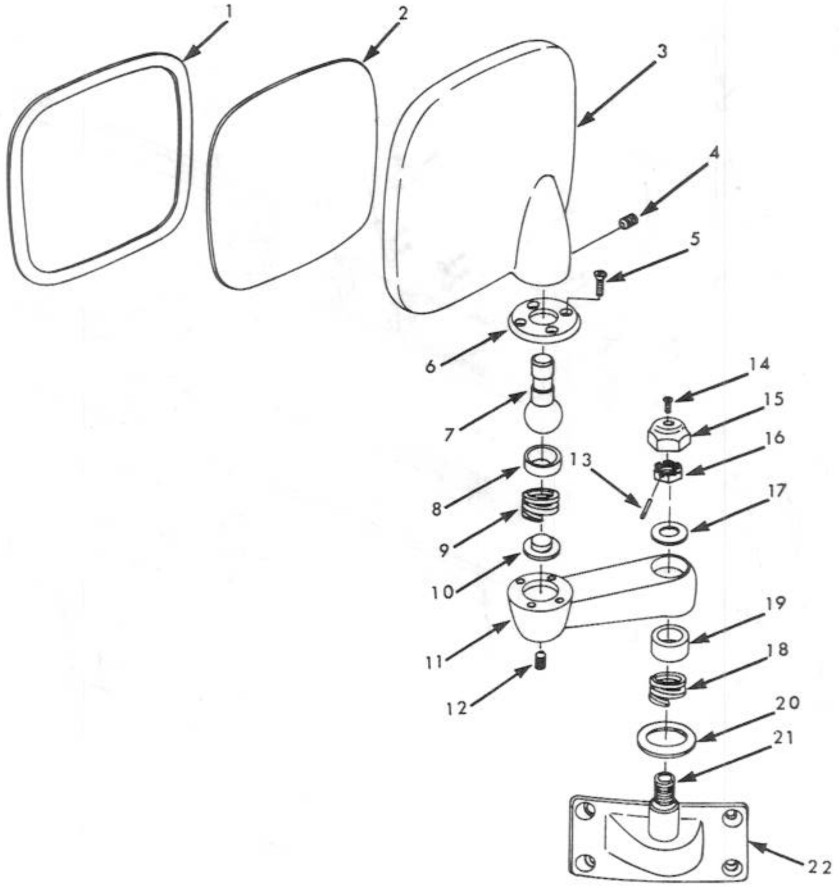
1.	Frame S/A	16.	Panel - Outer Upper	32.	Seal - Door Bottom
2.	Z-Channel	17.	Panel - Outer Lower	33.	Retainer
3.	Hat Channel S/A	18.	Rub Rail	34.	Block
4.	Z-Channel S/A	19.	Casting - Rub Rail End	35.	Cap
6.	Bracket	20.	Stiffiner Plate	36.	Hinge Panel S/A
7.	Bracket	21.	Eye Bolt	37.	Hinge Section - Mtg. to door
8.	Z-Channel S/A	22.	Yoke	38.	Hinge Section - Mtg. to body
9.	Z-Channel	23.	Clevis Pin	39.	Tube S/A - Door Hinge
10.	Z-Channel	24.	Spring	40.	Nylon Tube
11.	Z-Channel S/A	25.	Lock Plate	41.	Clip S/A
12.	Z-Channel S/A	26.	Bumper - Door Guard	42.	Block
13.	Box S/A	27.	Bracket	43.	Cap
14.	Hinge	30.	Rod	44.	Casting - Door Lock
15.	Handle S/A	31.	Stop - Lock Rod	45.	Casting - Door Lock

FIGURE 3 - 13: Baggage Door Assembly
(Effective Unit No. 10501)



1. Bezel
2. Glass
3. Mirror Back
4. Set Screw - 1/2 - 20
5. Screw - 12 x 3/4 PH.O.HD.
6. Ball Stud Cap
7. Ball Stud
8. Ball Stud Seat
9. Spring
10. Retainer
11. Arm
12. Set Screw - 3/8 - 16 x 3/4
13. Cotterpin
14. Screw - 10-32 x 5/8
15. Cap Nut
16. Nut
17. Fibre Washer
18. Spring
19. Spacer
20. Fibre Washer
21. Swivel Stud
22. Bracket

FIGURE 3 - 14: Exterior Rear View Mirror

EXTERIOR REAR VIEW MIRRORS

DESCRIPTION

Exterior rear view mirrors have replaceable glass sections and can be easily replaced if broken. To prevent breakage of windshield glass, driver window glass or other window glass by sudden slamming, adjustable bumper screws are installed in mirror arms. Two bumper screws are installed in each left and right hand mirror arms. Also, three rubber bumpers are installed in each left and right mirror heads.

ADJUSTING MIRROR HEAD

At the bottom of mirror arm (11) tighten or loosen socket head screw (12) which will tighten or loosen tension on mirror head ball stud (7). If necessary, mirror arm assembly can be disassembled, and tension components repaired or replaced.

ADJUSTING ARM TO BRACKET TENSION

At body end of mirror arm (11), remove screw (14) cap nut (15) to arm stud (21). Remove cap nut. Remove cotter pin (13) from jam nut, then tighten or loosen jam nut to desired tension. If necessary, arm can be disassembled and tension components replaced.

ADJUSTING MIRROR ARM STOPS

At inside of mirror arm, loosen lock nut retaining bumper screw to arm. With mirror arm to bracket tension slack, swing arm each way to extreme end of travel, touching coach body, windshield or window glass. Turn out bumper screw to provide sufficient clearance to prevent glass, body or mirror damage. Secure bumper screw by tightening bumper screw lock nut.

DISASSEMBLY OF MIRROR ARM

At mirror end of arm, loosen set screw (12) to relieve spring tension on ball stud (7). Remove four screws (5) which attach ball stud cap (6) to mirror arm (11). Remove cap, ball stud (7), ball stud seat (8), spring (9) and spring retainer (10) from arm. At bracket end of arm, remove screw (14) attaching cap nut (15) to arm stud (21). Remove cap nut. Remove cotter pin (13) from jam nut (16) remove nut, fibre washer (17) from arm stud. Remove arm from stud, then remove large fiber washer (20) from arm stud bracket.

ASSEMBLY OF MIRROR ARM

Assemble arm in reverse of disassembly procedures above.

REPLACEMENT OF MIRROR GLASS

Remove eight screws which attach mirror bezel (1) to mirror head (3), then with a thin blade pry bezel from head. Remove broken mirror glass. Position glass with tape in mirror head. Position bezel (1) over glass to head and secure with eight screws. **IMPORTANT:** Tighten screws evenly and firmly.

VENTILATION

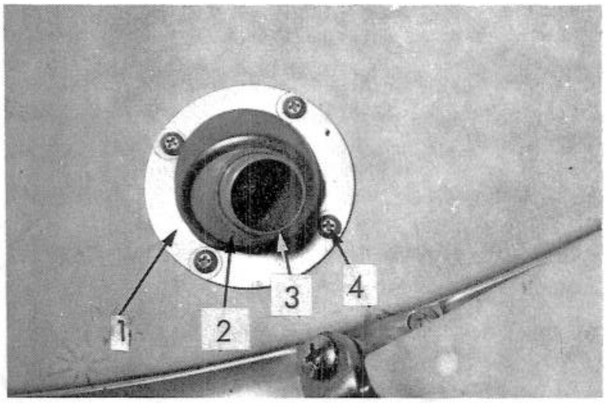
Recommended setting of interior air duct outlets and fresh air intakes and exhausts are as follows:

(a) Front Roof Exhaust - 2 turns open (¼ inch).
(b) Fresh air intakes both sides - Full open. (Reduce opening in Colder Weather Operation)
(c) Stepwell air ducts - 1/3 open.
(d) Side air duct dividers - 1/3 to the front - 2/3 to the rear.

DRIVER'S AIR VENT

DESCRIPTION

A vent mounted on panel above and between driver's window and windshield provides fresh air for driver's comfort. Intake vent is mounted on windshield cap on L.H. side of coach and transmits flow of air, via a flex hose, to vent shown in illustration. Turning valve counter-clockwise opens vent and clockwise closes vent.



1. Ring Retainer
2. Body
3. Valve
4. Screw - PH. TR. HD.

FIGURE 3 - 15: Driver's Air Vent

ENTRANCE DOOR

DESCRIPTION

The entrance door is held in the closed position during coach operation by an air cylinder-operated locking mechanism. A single-acting air cylinder is used, having a return spring in the cylinder body. The air cylinder is controlled by an electrically operated valve which is energized by a micro-switch located in the manual door control mechanism.

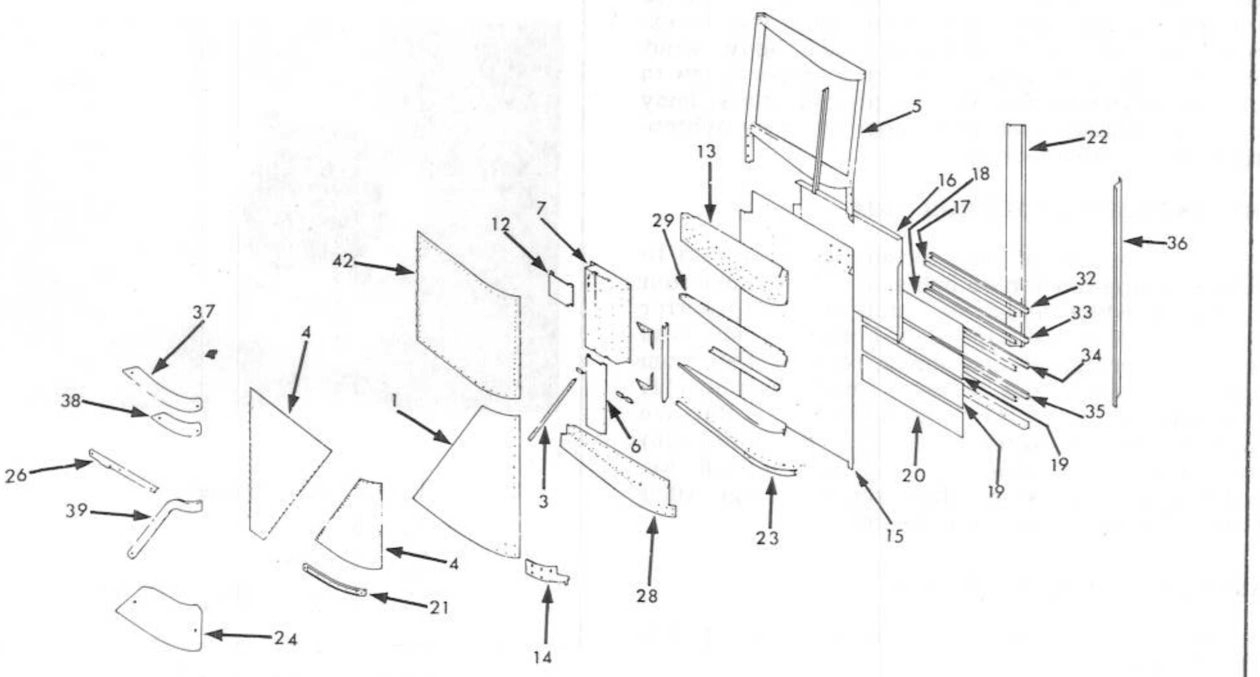
With the entrance door in the closed position, the micro-switch is closed, energizing the air valve and loading the door lock cylinder. The cylinder moves the door lock in a position which engages a latch on the entrance door, holding the door positively closed.

To open the door, initial movement of the door operating handle opens the microswitch, de-energizing the air valve and venting the cylinder. The action of the return spring in the cylinder moves the door lock away from the latch. Further movement of the door control handle opens the door.

An adjustment is provided at the micro-switch in the event that this unit requires replacement.

The micro-switch is located under the dash directly beneath the door control handle. The correct adjust-ment is obtained when the micro-switch contacts close as the door control mechanism begins to pass center during closing of the door.

An overrule switch, which opens the air valve circuit regardless of the position of the micro-switch is provided under the dash at the operator's position. This is designed for use in emergencies or when the door control system does not function properly.



1. Panel - Lower Front
2. Panel - Beaded, Lower Rear
3. Angle
4. Panel - Beaded, Lower Front
5. Frame S/A
6. Channel S/A
7. Channel
12. Plate S/A
13. Box S/A
14. Hinge S/A
15. Panel Only
16. Vinyl Only
17. Track
18. Panel - Upper
19. Panel - Center Upper & Lower
20. Panel - Bottom
21. Hat Channel S/A
22. Molding
23. Seal
24. Bumperette S/A
26. Molding
28. Box S/A
29. Z-Channel S/A
32. Molding - Upper
33. Molding - Center Upper
34. Molding - Center Lower
35. Molding - Bottom
36. Cap S/A
37. Molding S/A - Long Horiz.
38. Molding S/A - Short Horiz.
39. Molding S/A - Vertical
42. Panel - Beaded Upper Outer

FIGURE 3 - 16: Entrance Door Assembly

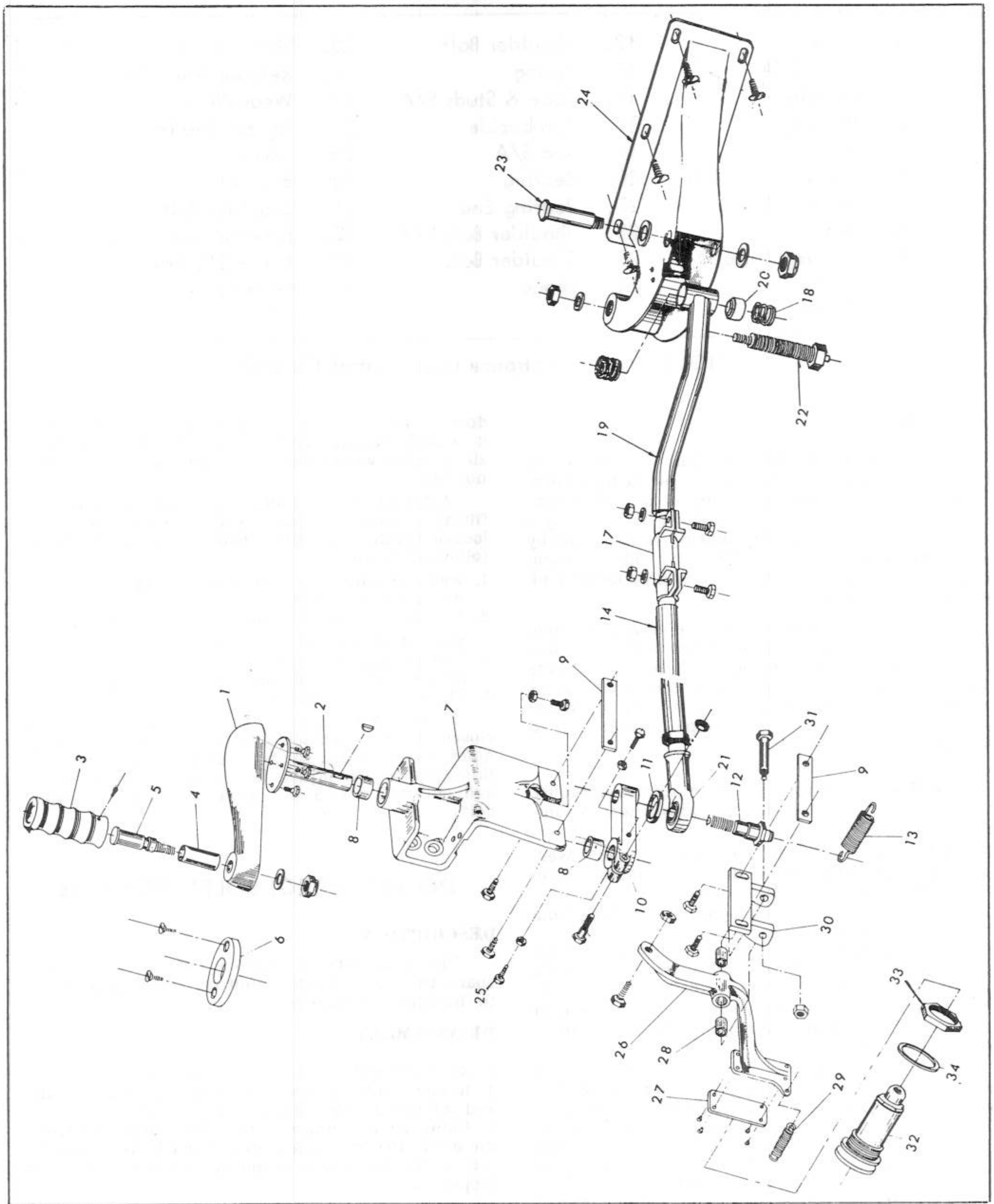

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FIGURE 3 - 17: Entrance Door Control

1. Lever
2. Shaft S/A
3. Handle
4. Bushing
5. Pin
6. Spacer - $1\frac{1}{2}$" I.D.
7. Bracket S/A
8. Bearing
9. Tapping Plate
10. Lever
11. Collar
12. Shoulder Bolt
13. Spring
14. Tube & Studs S/A
17. Turnbuckle
19. Rod S/A
20. Bearing
21. Bearing End
22. Shoulder Bolt S/A
23. Shoulder Bolt
24. Hinge
25. Stop Screws
26. Release Arm S/A
27. Wear Plate
28. Nylon Bushing
29. Spring
30. Bracket
31. Shoulder Bolt
32. Exterior Lock Assy.
33. Nut - 2", Brass
34. Flatwasher

FIGURE 3 - 17: Entrance Door Control (Cont'd)

ADJUSTMENTS

CONTROL ROD: (Prior to Unit No. 11134), adjust by loosening two jam nuts and turning turnbuckle to correct length of control rod. (Effective Unit No. 11135), control rod may be adjusted by a locked type turnbuckle. Turnbuckle is accessible by an access door at top right hand side of dash. Tighten jam nuts or locking bolts after desired adjustment is obtained.

If further adjustments are necessary, remove target panel at front below windshields, the jam nut at unibal end can be loosened and adjustments can be made by turning unibal end in or out as required. To retighten jam nut, it may be necessary to use a vice-grip or a pipe wrench to hold control rod from turning.

CAUTION: Control rod bend at unibal end must point toward rear of coach when adjustment is completed.

CONTROL HANDLE: The open-lock and closed-lock positions can be adjusted. Viewing linkage from underside of dash, proceed as follows:

1. Loosen jam nuts on stop screws protruding from the control handle lever.
2. Turn stop screws in or out to desired setting.
3. Tighten jam nut and check adjustment by moving control handle from open lock to closed lock positions.

Properly adjusted mechanism will swing over center and lock door firmly in both fully-open or closed positions.

MICRO-SWITCH: This can be adjusted if it does not energize or de-energize at correct times. The mounting bracket of the switch has slotted holes allowing it to be moved backward or forward. By loosening the mounting bolts, the bracket and switch can be set to a position where it will energize at correct position of lever and entrance door.

CAUTION: Switch must energize when entrance door is fully closed. If switch is set too far forward, it would energize and actuate the solenoid valve which in turn controls the air cylinder before the door is fully closed. If switch is set too far back, it would energize and actuate the solenoid valve air cylinder would not be actuated and door would not lock.

AIR CYLINDER: Can be adjusted to provide close fitting of entrance door. If door vibrates or is not locked firmly in position, make adjustments in the following manner:

1. Remove panel on rear wall of stepwell to gain access to air cylinder.
2. Remove cotter pin and yoke pivot pin to free yoke at anchor end of air cylinder.
3. Loosen jam nut and turn yoke to lengthen or shorten stroke of piston rod as necessary.
4. Tighten jam nut and re-assemble.

Further adjustments can be made to provide a closer fit between latch nose and latch pad. Slotted holes are provided in the latch nose mounting for this purpose. To adjust, loosen the mounting bolts and set latch nose at the desired position. Retighten bolts.

DOOR CONTROL SOLENOID VALVE

DESCRIPTION

The door control solenoid valve located in the spare tire compartment controls the supply of air to the door lock cylinder.

DISASSEMBLY

1. Shut off pressure to the valve and electric current.
2. Remove nut at top of coil cover. Cap, coil housing and coil can then be removed from body.
3. Using wrench unscrew the sleeve assembly from the body. DO NOT use a pipe wrench, as a wrench may crush the sleeve assembly and make the valve inoperative.

INSPECTION

1. If the valve fails to operate, the coil should be

1. Adapter
2. Adapter Seal
3. Nut
4. Nameplate
8. Coil & Housing Assy.
11. Sleeve Assy.
12. Plunger Assy.
13. Coil Spring
14. Body Blank
15. Flange Seal

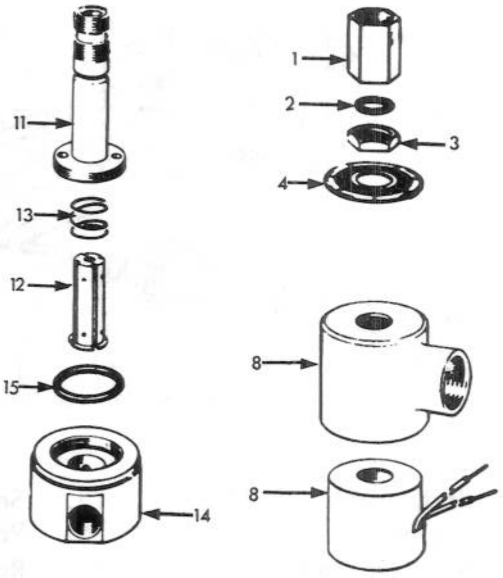


FIGURE 3 - 18: Ent. Door Solenoid Valve

checked to make sure it is not burned out.

2. Occasionally, if mishandled, valves may leak at the flange seal. If the medium is a liquid, such a leak may damage the coil. A flange leak may be corrected by tightening the sleeve assembly into the valve body or replacing the gasket.

3. If the valve leaks at the seat or the plunger sticks in the energized position, examine the soft inserts in the plunger and the inside of the sleeve assembly for the presence of excessive dirt or wear. If the inserts show considerable wear, the plunger should be replaced.

4. If the valve develops a loud buzzing noise, examine the inside of the sleeve assembly and upper portion of the plunger and remove all foreign matter imbedded in these parts.

If the valve leaks internally, examine the piston insert for excessive wear. Also inspect main exhaust orifice for dirt accumulation, scratches and nicks.

If the valve is sluggish during energization and de-energization, check for dirt accumulation or wear on both piston and piston bore. The piston should slide freely into the piston bore without binding. Inspect and clean all passageways of dirt or foreign matter.

REASSEMBLY

Reassemble the valve by following the disassembly procedure in reverse order. Make sure the seal at the flange end of the assembly and the return spring are in place when the sleeve is screwed into the body. After screwing the flange into the body and before assembling the coil to the valve, it is advisable to apply pressure to the port which leads to the body chamber and check for leakage around the flange. If the valve has a sleeve port, this port at the top of the valve must be capped to make this test. If the medium is air or gas, leakage can be noted by applying water to the joint and watching for air bubbles. If the medium is liquid, leakage is readily apparent. DO NOT tighten the nut at the top of the coil housing excessively, since doing so will put an undue strain on the sleeve assembly.

WINDSHIELD WIPERS

DESCRIPTION

Two heavy duty "Super Challenger" air operated windshield wipers are installed, controlled by two small knobs situated at the lower right side of the instrument panel. Each knob controls its corresponding windshield wiper.

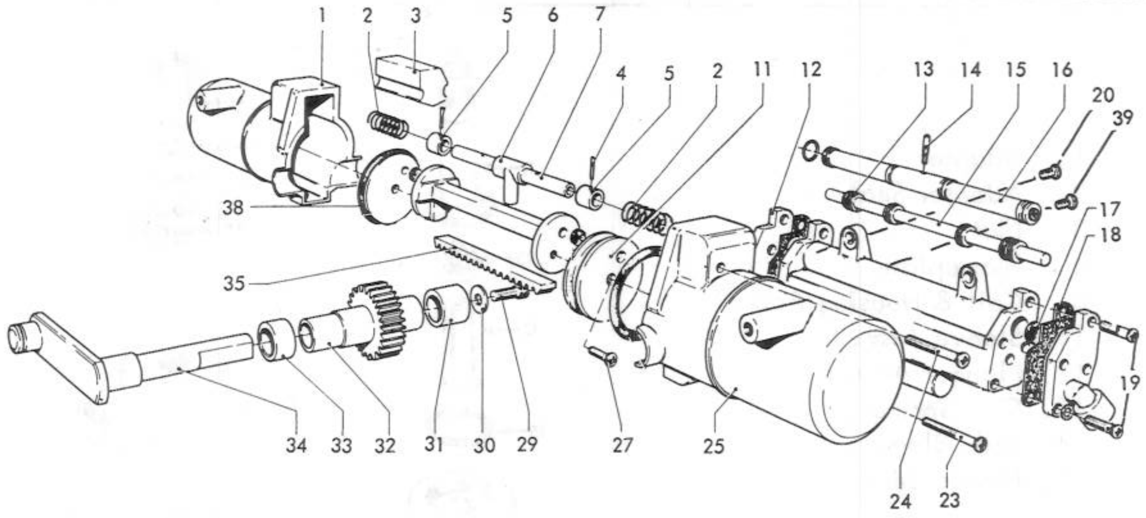
MAINTENANCE

Wiper motor, control valves require no periodic maintenance between overhaul. At overhaul, the windshield wiper motors and wipers should be disassembled, cleaned and lubricated.

Every 100,000 miles, the air strainer should be disassembled and cleaned.

REMOVAL AND REPLACEMENT

Windshield wipers may be removed from the exterior of the coach. To remove first remove windshield wiper blades, arms and pantograph arms. Remove wiper shaft spacer retainer nut. Remove



1.	Body Assy. - R.H.	15.	Secondary Rod	29.	Allen Screw
2.	Spring	16.	Primary Rod	30.	Back-up Washer
3.	Bearing Block	17.	Rubber Disc.	31.	Rear Bearing
5.	Reverser Stop	18.	Gasket	32.	Gear Sleeve Assy.
6.	Reverser Tee	19.	Screw	33.	Front Bearing
7.	Reverser Rod	20.	Screw	34.	Transmission Shaft
11.	Piston Retainer	23.	Screw	35.	Gear Rack
12.	Parking End Plate R.H.	24.	Screw	38.	"O" Ring
13.	"O" Rings	25.	Body Assy. - L.H.	39.	Screw
14.	Valve Pin	27.	Screw		

Figure 3 - 19: Windshield Wiper Motor

left or right hand corner moldings. Disconnect air lines to wiper motor. Remove wiper motor mounting panel retaining screws and lift out complete assembly.

DISASSEMBLY

The motor consists of four sub-assemblies; the valve, the body (two halves), the piston, and the shaft and gear assembly. Sub-assemblies may be replaced as complete units, or they may be disassembled and repaired.

To disassemble the wiper motor, proceed as follows: Remove valve assembly by unscrewing the four mounting screws; lift off carefully with body seals. Place right half of body in a vise so that joining screw heads are up. Tighten vise only enough to hold. Unscrew and remove the two body joining screws. Holding the output shaft with one hand, gently lift off upper body half. Note position of marks on gear and rods and remove shaft and gear assembly. Remove bearing block. Note position of valve reverser in body slot, and remove piston assembly.

To reassemble, reverse the above procedure, making sure to replace valve reverser and shaft and gear assembly in the same position as when disassembled.

REPAIR

To repair valve, remove end plates from both ends of the valve. Rubber discs are cemented in place and should not be removed unless replacement is necessary. (Pick out with a knife and scrape clean; cement new discs in place with a good rubber cement). Unscrew valve pin projecting from body side and push out valve rods. Remove "O" rings from both valve rods. Clean all parts except "O" rings in a good grade of solvent. Wipe "O" rings with a clean cloth. Replace worn or defective parts. The use of new gaskets and "O" rings is always recommended.

Reassembly is the reverse of the above procedure. Valve rods should be coated with "Air Push" grease. End plates should be sealed with gasket sealer.

Body halves cannot be further dismantled. Either half can be replaced. Before reassembly all parts should be coated with "Air Push" grease. The bearing block should be soaked in light oil for 24 hours.

To disassemble piston, remove "O" rings and "O" ring adaptors. Insert knife in recessed holes and remove rubber disc. Replace if necessary. Slide out reverser rod assembly and catch spring. Reverser stops may be removed by tapping out roll pin with a small drift. However, do not remove unless absolutely necessary. Remove self-lock screws holding the gear rack, noting position of assembled gear rack. Clean and examine all parts, replacing those showing excessive wear. New "O" rings should be installed. Grease "O" rings and rack liberally with "Air Push" grease.

Remove Allen screw, back up washer and rear shaft bearing. Slide gear sleeve off shaft and remove front bearing and retaining washer. Clean and examine all parts, replacing those which are worn. Oilite bronze bearings should be soaked in light machine oil for 24 hours. Reassemble in reverse order, lubricating parts with "Air Push" grease.

WIPER BLADE ANGLE ADJUSTMENT

Pantograph shaft length is adjustable to allow setting wiper blade angle. Each blade should travel across windshield in a position so that when the arm is at the end of its outward sweep, the wiper blade is parallel with the edge of the windshield. Adjust angle of blade as follows:

Loosen lock nuts on pantograph shaft. Remove crown nut which attaches shaft arm to pivot shaft. Remove arm from shaft. While holding outer end of pantograph shaft, turn shaft arm to shorten or lengthen shaft assembly. Reinstall arm on pivot shaft. Force arm and blade across wetted glass and check angle of blade. Repeat if necessary, then install crown nut on pivot shaft and tighten firmly. Tighten lock nuts on pantograph shaft.

WINDSHIELD WASHERS

DESCRIPTION

An air-operated windshield washer is installed with components mounted as shown on Figures 3-20 and 3-20A. This kit incorporates nozzles adjustable 360° both vertical and horizontal. Lines are purged automatically both before and after spray cycle, eliminating freezing or clogging of lines and nozzles. A closing plate is provided on top of the reservoir for refilling purposes.

An independent washer control knob is situated on the instrument panel alongside the two windshield wiper knobs.

DESTINATION SIGN

DESCRIPTION

The destination sign is located above the front windshield. An optional side destination sign is mounted on the right hand front side of the coach.

MAINTENANCE

It is recommended that the following inspections and checks be made on a regularly scheduled basis.

(1) Check to see if mechanism runs free and easy. Crank handle on destination sign, if it seems to bind, check gears for lodgement of foreign objects.

(2) Check for loose items such as wires, clips, hanging tape etc. Repair or remove such items.

(3) Inspect the inside of the destination sign compartment. Remove dirt and foreign objects. Clean inside of compartment well and keep door closed.

(4) If curtain is loose on rollers, run curtain to one end and turn crank handle until curtain roll is tight on roller. Run actuating mechanism through full cycle of curtain and repeat tightening action on opposite end of curtain.

(5) Periodic lubrication to the mechanism is recommended.

SIGN CURTAIN REPAIR

In event a destination sign curtain is torn, it can be repaired with 3M polyester tape or any equivalent cellophane tape. When repairing a tear, the tape should be used on both sides of the curtain.

DRIVER'S SEAT

ADJUSTMENT

The driver's seat may be adjusted for and aft by pushing in lock lever located at left front of seat. When seat is positioned, release lever. The back of the seat cushion can be tilted up or down by grasping a large knob at left corner of driver's seat and turning forward to lower and backward to raise. Seat may be raised by grasping and firmly pulling seat frame up. To lower, raise seat to highest position, then lower seat to lowest position. From there raise seat to desired height.

CAUTION: Seat belts are to be worn at all times. For maximum protection they should be pulled tight to fit snugly—with webbing bearing on hip bones and pulling downward and rearward at 45 degree angle.

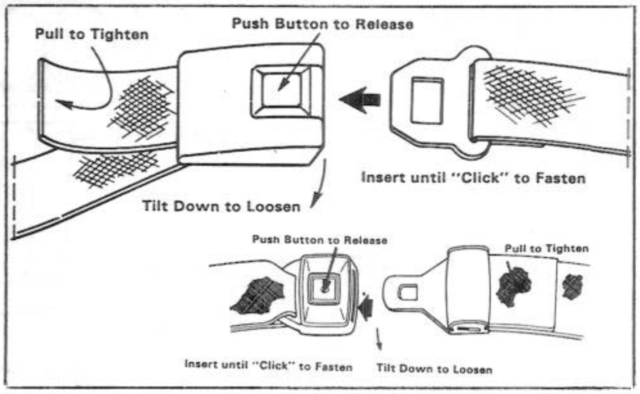
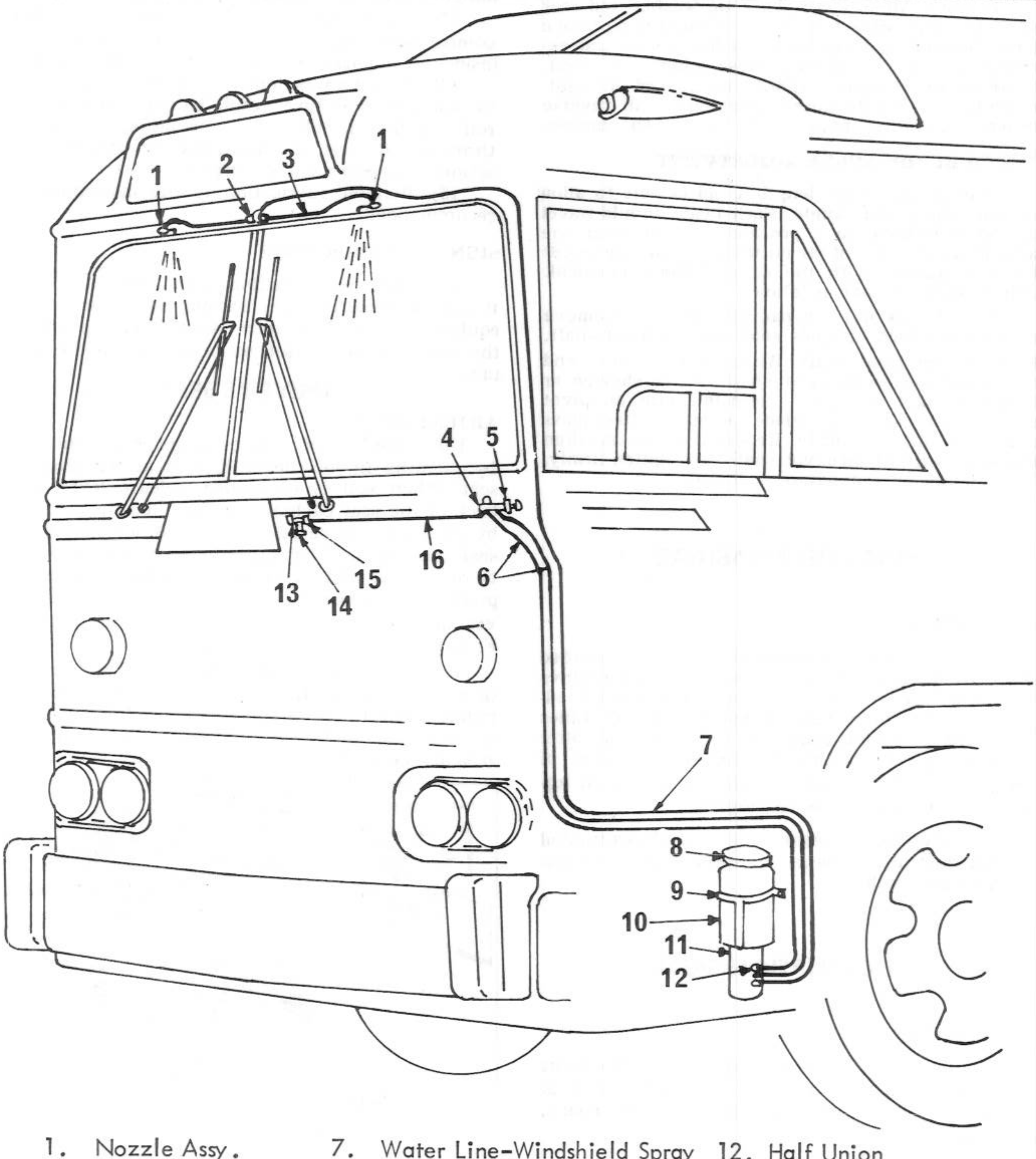


Fig. 3-19A: Seat Belt Lock Mechanism

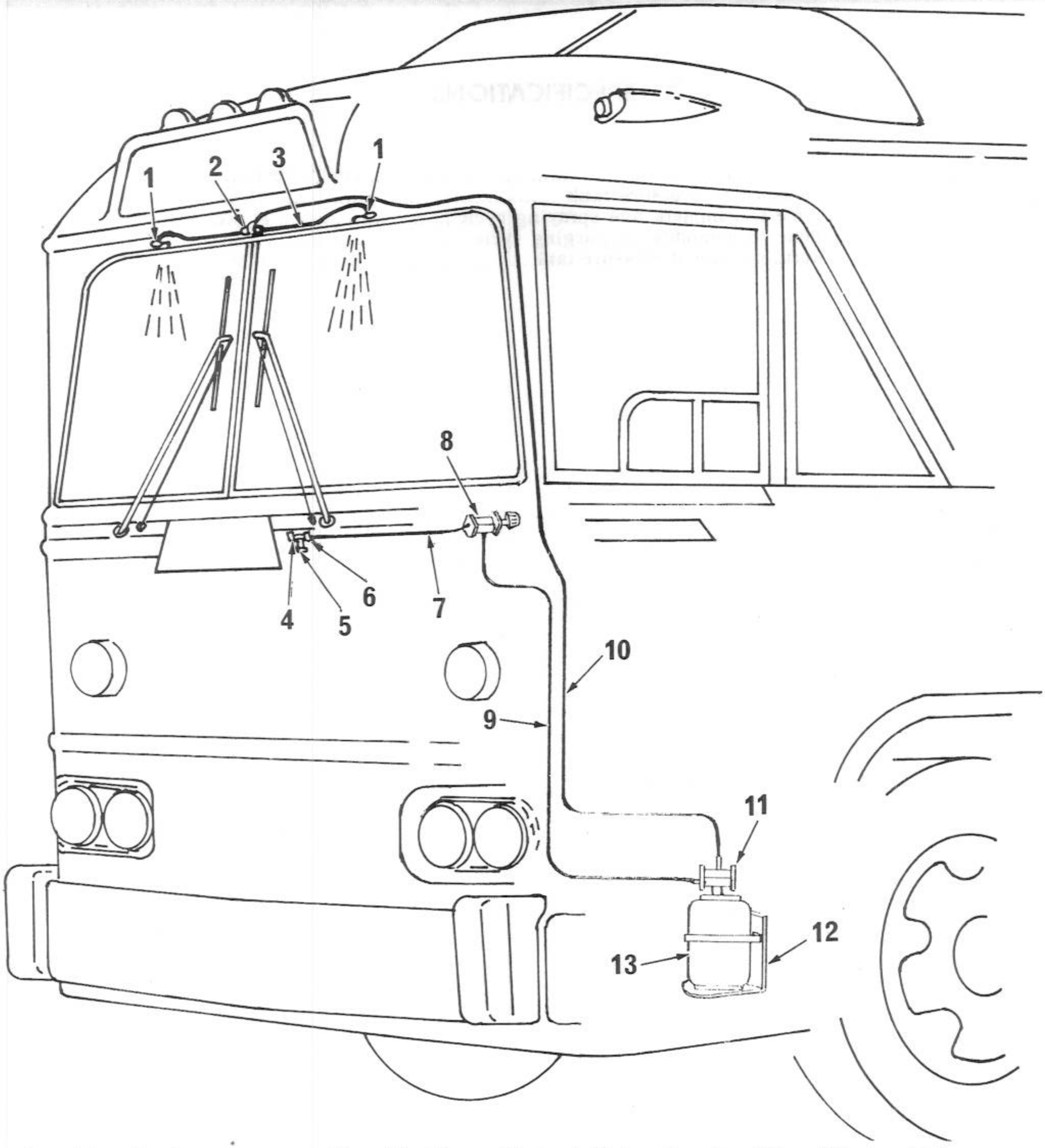
MAINTENANCE

It is strongly recommended that floor fittings be inspected for looseness and the floor checked for corrosion at least twice a year. If it becomes necessary to clean the webbing, use a mild detergent with lukewarm water. Do not re-dye or use solvent type cleaners on webbing as this may weaken the fibers or affect the original dye or when fraying takes place replace belt.



1. Nozzle Assy.
2. Hose Tee
3. Water Line - Nozzle
4. Elbow
5. Control valve
6. Air Line
7. Water Line-Windshield Spray
8. Bottle Cap Assy.
9. Bracket Assy.
10. Water Reservoir Tank
11. Pressure Tank Assy.
12. Half Union
13. Tee
14. Bushing
15. Brass Insert
16. Air Supply Line

FIGURE 3 - 20: Windshield Water Installation
(External Pump)



1.	Nozzle Assy.	7.	Air Line - Control Valve Supply	11.	Washer Valve
2.	Hose Tee	8.	Control Valve	12.	Mtg. Brkt.-Water Reservoir
3.	Water Line - Nozzle	9.	Air Line - Control valve to washer valve	13.	Water Reservoir Tank
4.	Tee	10.	Water Line - Windshield Spray		
5.	Bushing				
6.	Brass Insert				

FIGURE 3 - 20A: Windshield Water Installation (Internal Pump)

SPECIFICATIONS

Capacity of reservoir	1 gal. (.825 Imp.)
Capacity of pressure tank	15 oz.
Time to complete one spraying cycle	14 sec.
Time to complete on purging cycle	3 sec.
Refilling time of pressure tank	10 sec.

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

[illegible] MAINTENANCE MANUAL

Service Bulletins

[illegible] time to time [illegible] of such bulletins [illegible] should [illegible]

BRAKES & AIR SYSTEM

DESCRIPTION

The air system of the coach provides a means for braking, suspension, and for operating controls and accessories. This section covers brakes and air operated accessories. Details of the suspension system are covered in Section 12 (Suspension) of this manual. Air-operating entrance door mechanism is covered in Section 3 (Body). The air assisted engine clutch operating mechanism is covered under Section 5 (Clutch). The radiator shutter control system is covered under Section 6 (Cooling). The air-operated lavatory dump mechanism is covered under Section 17 (Lavatory) if used.

A schematic diagram of all air system components is shown in Figure 4 - 1. The brake system components are shown in Figure 4 - 2.

The basic air system consists of a compressor (which is mounted on and driven by the engine), air reservoirs, filters, and the necessary fittings and piping.

The brake system consists of brake chambers (one at each wheel), brake application valve, quick release valve, relay valve, parking brake (push-pull) valve, reservoirs, check valves and filters, and necessary fittings and connecting piping.

BRAKE OPERATION

DESCRIPTION

The brakes used in this coach incorporate both service and parking air-operated brakes. Operation of the air-operated parking brake system is as follows. (Refer to Fig. 4-19).

NORMAL RUNNING - With the handle of the push-pull valve pushed in, air pressure from the parking and emergency reservoir is delivered to the control port of the inversion valve and thence to the lock port of the rear brake actuator. Air pressure acting on piston A moves it forward and contacts rollers B rolling them up ramp A-A. As long as air pressure remains in lock port area, rollers B are not in contact with shaft F and normal service brake applications will permit shaft F to move freely.

PARKING - To park, the handle of the push-pull valve is pulled out. This vents the control port of the inversion valve and the lock port of the rear brake actuator. Spring D then forces rollers B against collar G thereby engaging rollers B with shaft F.

When the control port of the inversion valve is vented, piston H moves forward to contact exhaust valve J. This action opens passage between parking and emergency reservoir port L and parking diaphragm port K. The valve then delivers 85 lb. regulated emergency reservoir pressure to the parking diaphragm of the actuator.

LOSS OF AIR PRESSURE WHILE PARKED - If there is a reduction of air pressure while parked, the force output of the diaphragm is reduced. The push rod force, however, is transferred to the mechanical lock mechanism to keep the brake applied. In this position rollers B are now wedged between collar G and shaft F preventing the return of shaft F to a released position. Shaft F is now locked in the applied position.

EMERGENCY OPERATION - If air pressure should be lost from the service reservoirs, the emergency brakes may be applied by pulling out the handle of the push-pull valve. Air from the emergency reservoir which is protected by a single check valve, applies the brakes as described under parking.

If air is lost from the emergency reservoir and the wet service reservoir, a normal stop can be made with the service brakes because the dry service reservoir is protected by a single check valve. If pressure is lost from the emergency reservoir at a relatively slow rate, a partial parking application will be made when the handle of the push-pull valve trips automatically at about 40 psi. The inversion valve will likewise automatically trip at about the same pressure and apply the parking brakes even though the push-pull valve does not trip.

NOTE: Air pressure gauge on dash does not show parking brake reservoir pressure. If pressure on gauge drops during operation, four parking brake applications can still be made. Parking and emergency brakes will not apply automatically until parking reservoir pressure drops below 40 lbs. If pressure on gauge drops below 55-60 lbs. during operation, "LOW AIR" tell-tale will flash and warning buzzer will sound. Coach should be stopped immediately and cause of air loss corrected before proceeding. A sudden, automatic parking brake application will only result if low air pressure warning signals are ignored.

RELEASE OF PARKING BRAKE

(1) When Emergency Pressure Has Not Dropped More Than 4 psi. After Applying The Parking Brake: Push in handle of push-pull valve. This applies reservoir pressure to the lock port of the actuator thereby releasing the locking mechanism. At the same time, air pressure is also admitted to the control port of the inversion valve which causes air to be exhausted from the parking diaphragm thereby releasing the brakes.

(2) When Emergency Pressure Has Dropped More Than 4 psi. After Applying The Parking Brake: Push in handle of push-pull valve. This applies reservoir pressure to the locking port of the actuator which releases the locking mechanism. Reservoir pressure is simultaneously applied to the control port of the inversion valve which in turn causes air to be exhausted from the parking diaphragm. A heavy service brake application will then produce sufficient forward motion of the actuator piston rod to allow the locking mechanism to disengage. Releasing the service brake application will restore the system to normal running condition.

NOTE: If an inadvertent service brake application

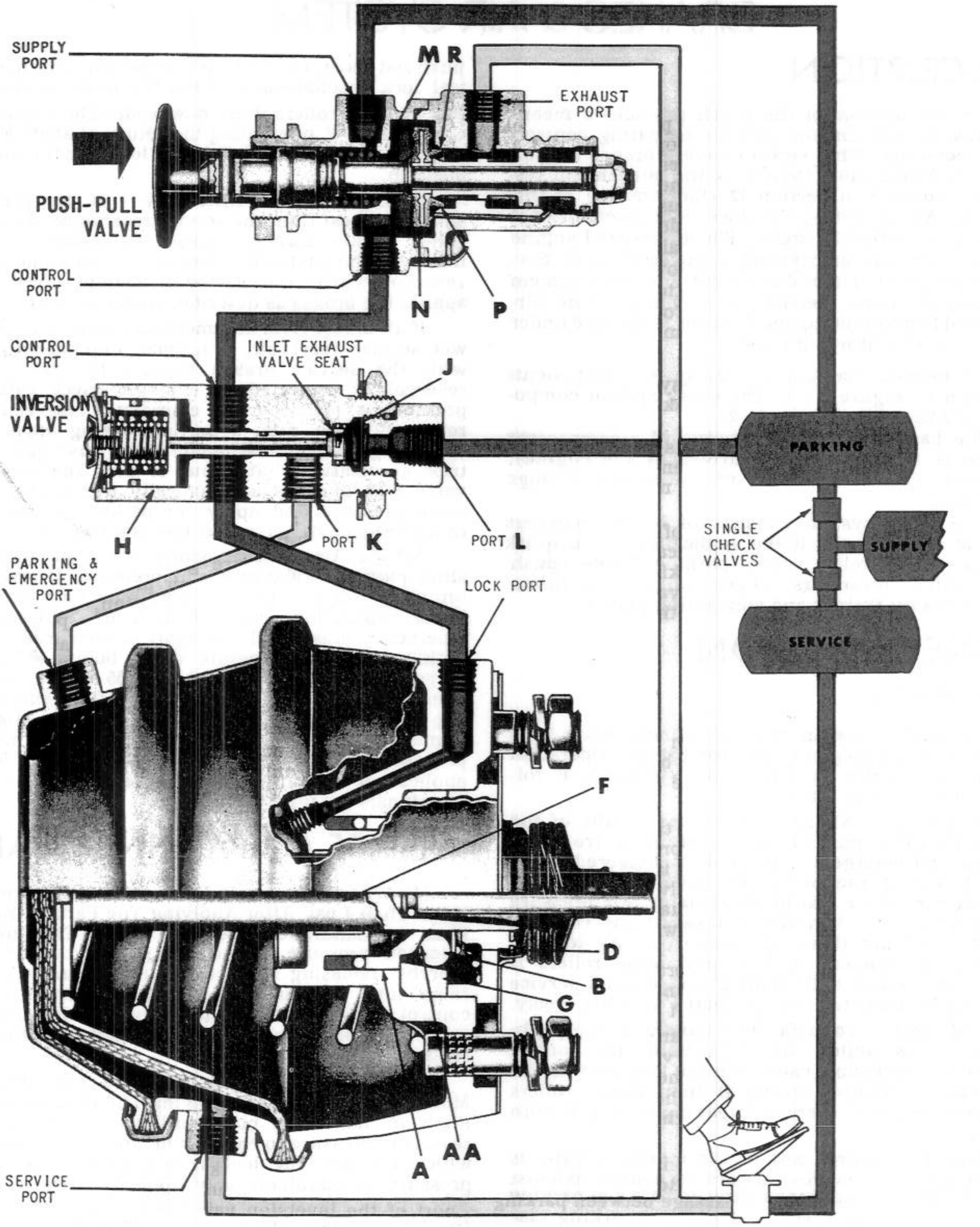
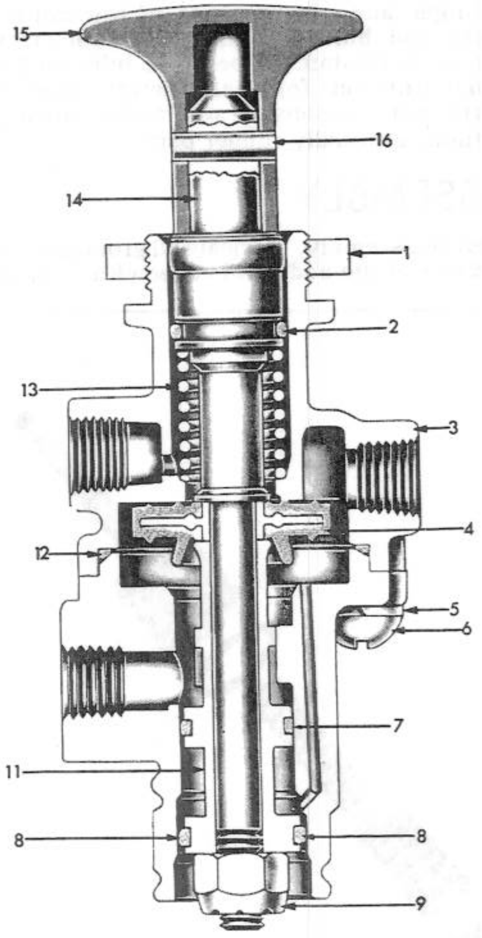

SUPPLY PORT
M
R
EXHAUST PORT
PUSH-PULL VALVE
CONTROL PORT
N
P
CONTROL PORT
INLET EXHAUST VALVE SEAT
J
INVERSION VALVE
PARKING
H
PORT K
PORT L
SINGLE CHECK VALVES
SUPPLY
PARKING & EMERGENCY PORT
LOCK PORT
SERVICE
F
D
B
G
AA
A
SERVICE PORT

FIGURE 1
DD3 SAFETY ACTUATOR

RED - RESERVOIR

YELLOW - ATMOSPHERIC

Parking Brake Schematic



1.	Nut
2.	Grommet
3.	Body
4.	Inlet & Exhaust Valve
5.	Lockwasher
6.	Machine Screw
7.	Grommet
8.	Grommet
9.	Hex. Nut
11.	Piston
12.	Sealing Ring
13.	Spring
14.	Plunger
15.	Button
16.	Spiral Pin

PUSH-PULL CONTROL VALVE

is made while the parking brakes are applied, the parking brakes will not release unless the handle of the push-pull valve is pushed in.

PUSH-PULL CONTROL VALVE

DESCRIPTION

The push-pull control valve is used to control the flow of air to the parking ports of the rear brake chambers. It is mounted on the coach floor to the right of the driver's position.

In normal operation, the push-pull control valve plunger is pushed down. To operate the parking and emergency brake, the plunger is pulled upward to the top position. The system then functions as outlined earlier in this section.

REMOVAL AND INSTALLATION

Block or hold vehicle by some means other than air brakes. Drain air brake system. Disconnect air lines from control valve. Drive out spiral pin that holds button on control valve plunger. Remove button. Remove control valve mounting nut, then control valve.

Before re-installing, clean air lines to control valve and brake actuators. Refer to Figure 4 - 11 or the Air Line Diagram for proper line connections to control valve.

DISASSEMBLY

Place the spring "cell" in a vise with pull rod bolt end up and the hex end of the rod held securely in the vise jaws. SLOWLY AND CAUTIOUSLY remove the pull rod bolt. This will release the spring load as the bolt is removed. Remove the springs. Remove the pull rod bolt from the piston. Remove the seal grommet from the pull rod bolt. Remove cover from the pull rod. Take pull rod out of vise.

The spiral pin, button, and mounting nut are removed at the time the valve is removed from the vehicle dash. Insert a punch or rod in the plunger pin hole to keep the plunger from turning when removing the nut at the bottom of the valve.

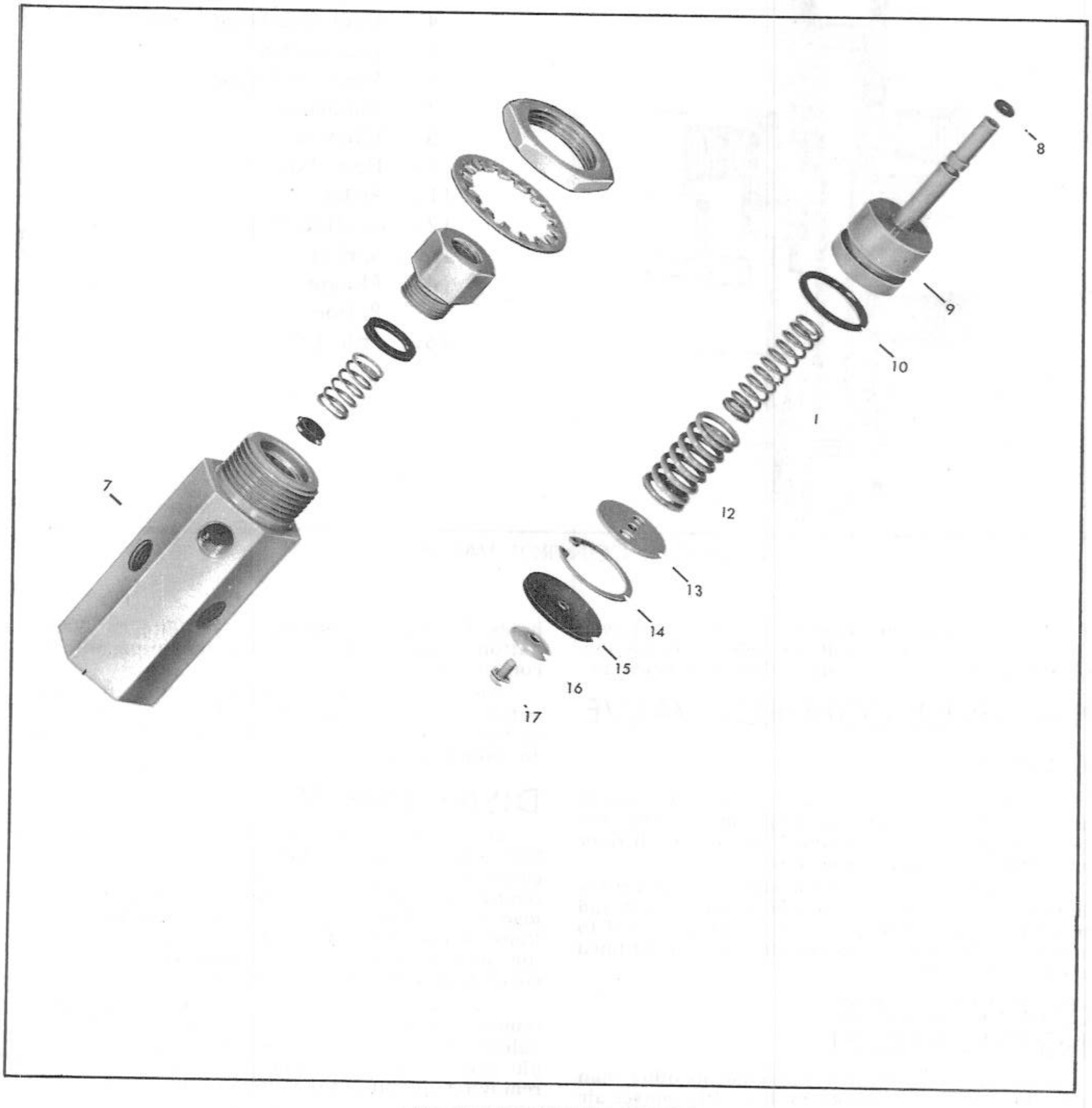
Remove the plunger and spring. Remove plunger grommet. Remove the two cover screws and separate the cover from the body. Remove the cover seal grommet and the inlet and exhaust valve. Remove the piston, then the lower large piston grommet, and then the upper piston grommet.

REPAIR

Wash all metal parts in a good cleaning solvent and dry. Wipe reusable rubber parts clean. Inspect all parts for excessive wear or deterioration. Inspect the plunger and piston bores of the control valve for nicks and burrs. Check springs for cracks, distortion, or corrosion. Inspect the inlet and exhaust valve and grommets for wear or deterioration. Replace all parts not considered serviceable during these inspections, especially rubber parts.

REASSEMBLY

Prior to assembly, lubricate all grommets and bearing surfaces of the body and cover with recommended



TR-2 INVERSION VALVE

lubricant, (MCI Part No. 4A-15-113). Install grommet on plunger. Place spring on plunger. Insert plunger, with spring and grommet installed, in body. Install inlet and exhaust valve over protruding end of the plunger. The double beaded side of the inlet and exhaust valve should be up against the body seat.

Position cover to body seal grommet in body. Attach the cover to the body with two screws. Install the piston grommet (large diameter grommet in bottom piston groove). Install the piston with grommets. Depress the plunger, and with a punch or rod hold it from turning while installing the plunger stem nut. Torque on the stem nut should be between 30 and 40 inch pounds. The control button should be installed and held in place by the spiral pin after the valve is mounted on the vehicle dash and held by the mounting nut.

INVERSION VALVE

DESCRIPTION AND OPERATION

When the control Valve is operated, the Inversion Valve operates permitting air in the isolated reservoir to apply the brakes. The Inversion Valve also operates automatically when air pressure drops to a predetermined pressure.

With no system air pressure, the inversion valve inlet valve is open and its exhaust is closed. On initial build-up, as air enters the isolated reservoir to which the inversion valve supply port is connected, it will pass by the open inlet and out the delivery ports. When the system pressure reaches between 50 and 60 PSI and the control valve is operated; air will pass into the inversion valve from the control valve. This air flows in one control port and exerts a force on the inversion valve piston. At a pressure between 60 and 70 PSI, the piston moves against the resistance of the two piston springs. The piston exhaust seat moves away from the inlet and exhaust valve, opening the exhaust passage. The inlet valve spring and supply air at the inlet valve will cause it to seat. Air will then exhaust from the exhaust port.

The air at the inversion valve control ports is exhausted through the control valve exhaust when it is operated. The piston springs will then cause the piston to move and seat on the inlet and exhaust valve closing the exhaust passage. The inlet valve is moved off its seat by the piston exhaust seat so supply air from the isolated reservoir will pass by the open inlet and out the delivery ports.

When the application is released by actuating the control valve, air passes into the inversion valve control port. The piston moves away from the inlet and exhaust valve, opening the exhaust passage through the piston. The inlet valve closes and air in the delivery ports exhausts through the center of the piston stem and out the inversion valve exhaust port.

MAINTENANCE

Every year of after 50,000 miles the inversion valve should be disassembled, cleaned and lubricated. Rubber parts should be replaced and any other parts which show signs of wear or damage should also be replaced.

REMOVAL AND INSTALLATION

Block and hold the vehicle by means other than air brakes. Drain, service and isolated reservoir suppiies. Disconnect all air lines from the inversion valve. Loosen the valve mounting nut and remove the valve. Check and clean air lines to the valve prior to installation. Mount the valve securely with mounting nut and lockwasher.

DISASSEMBLY

Remove the cap nut with sealing ring and remove the sealing ring from the cap nut. Remove the inlet valve spring and inlet valve. Turn the valve over and remove the exhaust check valve diaphragm cap screw with lockwasher, then diaphragm washer and diaphragm. With a pair of No. 1 Truarc pliers, remove the retainer ring. Remove the cover plate and two piston springs. Remove the piston with grommets. Remove the piston grommets.

REPAIR

Wash all metal parts in a cleaning solvent and wipe clean. Inspect all parts for excessive wear or deterioration. Check springs for cracks, corrosion, or distortion. Inspect the piston and its exhaust seat, body bores and inlet valve seat for nicks or burrs. Replace all parts not considered serviceable.

REASSEMBLY

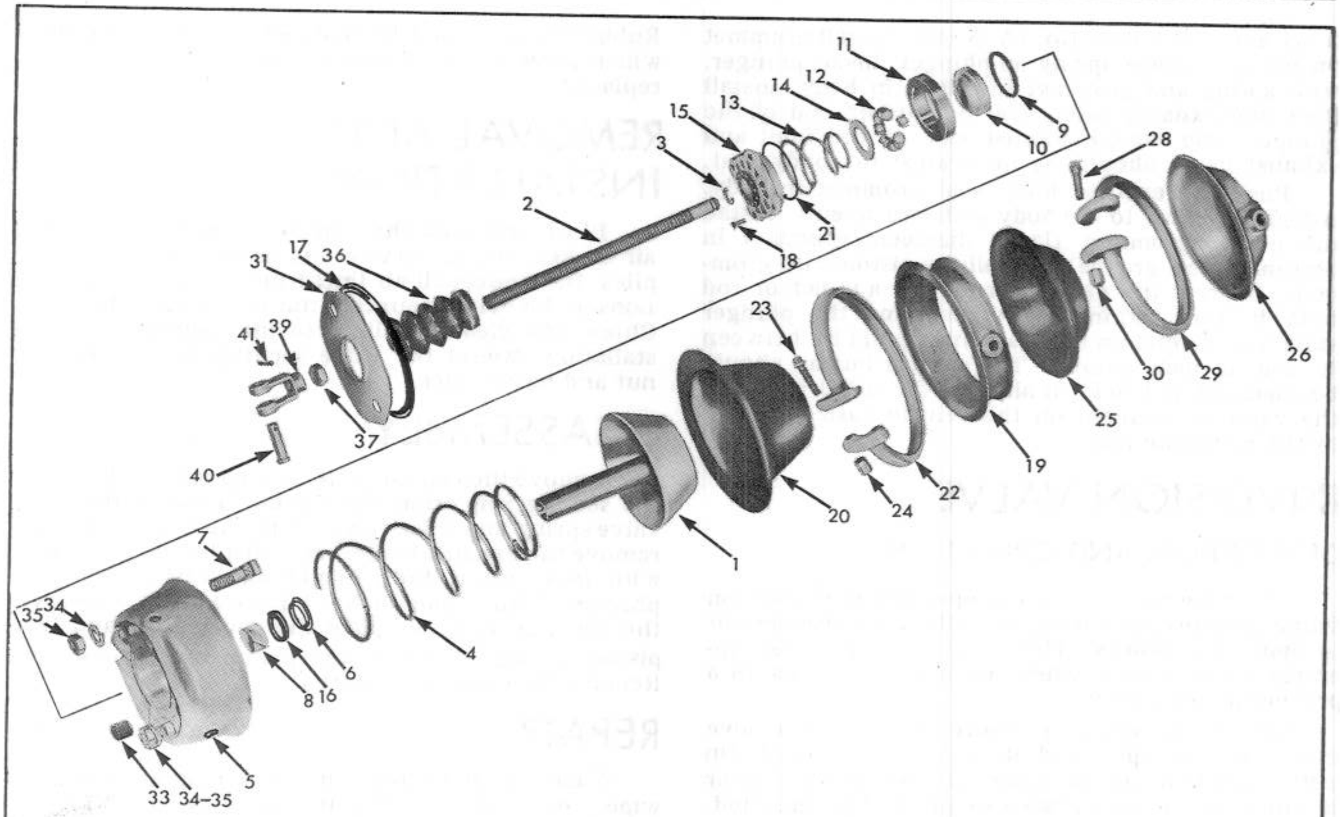
Before assembling the valve, lubricate the piston, grommets and body bores. Install the piston grommets on the piston. Install the piston with grommets in the valve body. Position piston springs, cover plate and retainer ring in the piston in that order. Press the cover and retainer down and with a pair of Truarc No. 1 pliers, snap the ring into the body groove. Install the diaphragm and diaphragm washer and secure with the cap screw. Turn the inversion valve over and position the inlet and exhaust valve in its bore. Place the spring down over the inlet valve. Install the sealing rings on the cap nut. Install the cap nut with the sealing ring and tighten securely. The mounting nut and lockwasher are installed when the valve is mounted on vehicle.

REAR BRAKE CHAMBER

DESCRIPTION

The rear driving axle brake chambers combine the functions of a conventional service brake chamber with a secondary diaphragm and locking mechanism to give emergency and parking operation.

Operation of the rear brake chambers under various conditions has already been described earlier in this section.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No.	Part
1.	Shaft Assy.
2.	Push-Rod
3.	Ring - Retaining
4.	Spring - Return
5.	Non-Pressure Plate Assy.
6.	Spring
7.	T-Bolt
8.	Bearing
9.	Grommet
10.	Piston
11.	Collar
12.	Roller
13.	Spring - Roller
14.	Washer
15.	Cap
16.	Seal
17.	Sealing Tube
18.	Screw
19.	Plate
20.	Diaphragm
21.	"O" Ring
22.	Clamping Ring
23.	Bolt
24.	Nut
25.	Diaphragm (Auxiliary)
26.	Plate
28.	Ring
29.	Bolt
30.	Nut
31.	Guard - Splash
33.	Felt
34.	Lockwasher
35.	Nut
36.	Boot
37.	Nut
39.	Yoke
40.	Pin
41.	Cotter Pin
42.	Valve Assy. - Exhaust & Check

REAR BRAKE CHAMBERS

MAINTENANCE

Depending on experience and type of operation, the drain slot in the actuator non-pressure plate should be checked and cleared of any restricting road grime, mud, ice, snow, etc.

Brakes should be adjusted as is customary with any brake chambers. Push rod travel should be as short as possible without brakes dragging. Excessive travel not only shortens the normal service life of diaphragms but gives slow braking response, wastes air, and could possibly result in decreasing brake torque.

Push rod to slack adjuster alignment should be checked in both the applied and released positions, the rod should move out and return properly without binding. Check the angle formed by the slack adjuster arm and push rod. It should be 90° or greater when the actuator is in the applied or released positions.

Every year or after 50,000 miles depending on type of operation disassemble the actuator, clean all parts and lubricate the locking mechanism. Install new diaphragms and other rubber parts if they are worn or deteriorated.

When diaphragms or return spring or both are replaced, like parts in the corresponding actuator on the same axle should also be replaced.

INSTALLATION

Block and hold the vehicle by some means other than air brakes. With the actuators in the released position, disconnect or completely remove the air lines from parking and service ports of the actuator.

CAUTION: Air will be exhausted out the line that is connected to the parking port when the control valve is operated. If this line is not removed, it should be disconnected in such a way that it will not whip and cause damage as the air exhausts.

After disconnecting only the parking and service port lines, operate the parking control valve. This action will exhaust the isolated air supply and air from the locking port.

As a safety precaution, the service system should also be drained, if it is separate. Disconnect the air line at the actuator lock port. Remove the yoke pin cotter pin and knock out the yoke pin. Remove the mounting nuts, then the actuator.

CAUTION: On installation actuators must be installed with the drain slot pointing down and towards the center line of the vehicle.

Mount actuator on the mounting bracket and tighten securely. Fasten the actuator push rod yoke to the slack adjuster with the yoke pin. Lock the yoke pin with a cotter pin. The angle formed by the push rod and slack adjuster arm should be greater than 90°.

Connect the air lines to the actuator. Take care that the correct line is installed in the correct port. Adjust brakes.

DISASSEMBLY

Clean the actuator exterior of all road grime then mark it in such a way so it can be assembled in the same manner. Remove yoke and yoke lock nuts. Remove boot, splash guard and felt breather. Remove auxiliary and service clamping ring nuts and bolts. Spread clamping rings slightly, just enough to slip them off the plates. It may be necessary to use a soft mallet driver to break the clamping rings loose. If the rings are being reused, caution should be taken against bending them out of shape.

After the clamping rings are removed, the auxiliary pressure plate, auxiliary diaphragm service pressure plate and service diaphragm are removed in that order. Place the remains of actuator on a smooth surface with the push plate down. Connect an air supply (shop air) line to the locking port. By hand press down on the actuator non-pressure plate and at the same time apply air to the locking port. As the shaft is unlocked, ease the non-pressure plate back and remove the push plate and shaft assembly with push rod and return spring. Hold the lock cap down against roller spring tension and completely remove all four cap screws before releasing and removing the cap. Remove roller spring and spring seat washer. Remove all eight rollers. Next cautiously apply air at the locking port to assist in removal of collar and piston, and to remove piston grommet. Inspect the bearing in shaft bore. Remove it only if it is showing signs of wear. The push rod should not be removed from the shaft unless it is damaged. If the rod is removed it must be replaced. To remove the rod, place a heavy washer over the rod against the shaft, then position a spacer and a second washer over the rod and beneath the yoke lock nut. Turn the lock nut down with a long handled wrench, pulling the push rod from the shaft. The knurled T-bolts in the non-pressure plate can be removed and replaced if damaged.

REPAIR

Wash all metal parts in a cleaning solvent and dry. Any reusable rubber parts should be wiped clean. Discard felt breather. Inspect all parts for excessive wear or deterioration. Particular attention should be given to the piston and collar bores in the plate. The air passage from the lock port to piston bore should be clean and not restricted. It may be necessary to remove the inspection plug to thoroughly clean this passage. Rollers should all be replaced if one or more need replacing. Check the springs for cracks, distortion or corrosion. Replace all parts not considered serviceable.

REASSEMBLY

On assembly, line up parts as they were marked prior to disassembly. Lubricate the piston and collar bores, shaft, piston grommet, piston and roller cavity with B-W240176 (barium base Spec 204M) lubricant. Position the piston grommet in the piston with smooth end down against the grommet. Place the collar in its bore in the plate. Position all eight rollers in the groove formed by the top of the piston and collar ramp. Place the roller spring seat washer on top rollers. Position the cone shaped roller spring on the washer with the small end to the washer. Po-

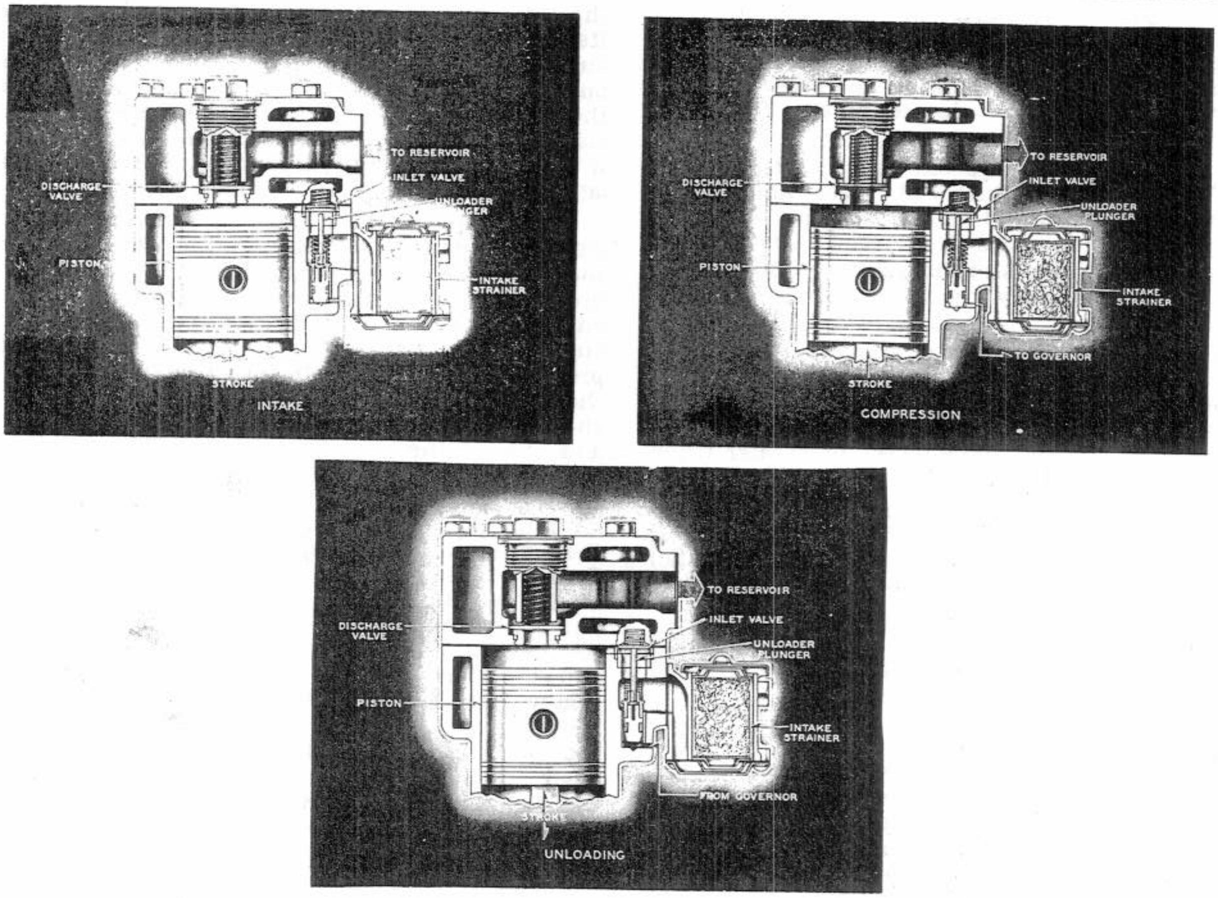

DISCHARGE VALVE
TO RESERVOIR
INLET VALVE
UNLOADER PLUNGER
PISTON
INTAKE STRAINER
STROKE
INTAKE
DISCHARGE VALVE
TO RESERVOIR
INLET VALVE
UNLOADER PLUNGER
PISTON
INTAKE STRAINER
TO GOVERNOR
STROKE
COMPRESSION
DISCHARGE VALVE
TO RESERVOIR
INLET VALVE
UNLOADER PLUNGER
PISTON
INTAKE STRAINER
FROM GOVERNOR
STROKE
UNLOADING

Figure 4 - 2: Air Compressor Operation

sition the cap on the roller spring. Press the cap down and hold while installing cap screws evenly. Turn the non-pressure plate with lock mechanism installed and position the return spring in the plate with the large end down. Position the push plate and shaft over the return spring and press down so the shaft moves through the lock. The lock should hold the shaft position against return spring. If not, check assembly to this point. Install the service diaphragm, service pressure plate and clamping ring. Install the auxiliary diaphragm, auxiliary pressure plate and clamping ring. Tighten clamping ring bolts in both clamping rings evenly. Install the boot and new breather felt, then the splash guard down over the boot.

AIR COMPRESSOR

DESCRIPTION AND OPERATION

The function of the air compressor is to build up and maintain the air pressure required to operate air powered devices in air system.

The compressor is a single stage, reciprocating piston type, having two cylinders. The rated capacity is 15 cubic feet per minute. The compressor is water-cooled, and engine oil-lubricated.

The compressor has automatic type inlet valves. Their unloading mechanisms are located in the cylinder block and they have no external moving parts.

The compressor runs continuosly while the engine is running but actual compression of air is controlled by a governor which stops or starts the compression of air by loading or unloading the compressor in conjunction with its unloading mechanism. This is done when the air pressure in the system reaches the desired maximum or minimum pressures.

INTAKE & COMPRESSION (Loaded): - During the downstroke of the piston, a slight vacuum created above the piston causes the inlet valve to move off its seat. Atmospheric air is drawn in through the compressor intake, past the open inlet valve, and on top of the piston. (Refer to Figure 4 - 2) As the piston starts its upward stroke, the air that was drawn in on the down stroke is being compressed. Now, air pressure on top of the inlet

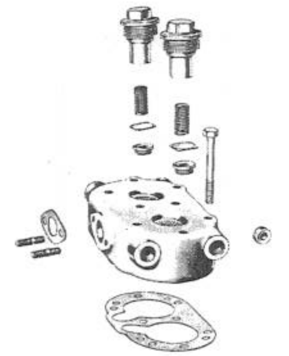


Figure 4 - 3: Cylinder Head

valve plus the force of its spring, returns the inlet valve to its seat. The piston continues the upward stroke and compresses the air sufficiently to overcome the discharge valve spring and upseat the discharge valve. The compressed air then flows past the open discharge valve, into the discharge line and on to the reservoirs.

As the piston reaches the top of its stroke and starts down, the discharge valve spring returns the discharge valve to its seat. This prevents the compressed air in the discharge line from returning to the cylinder bore as the intake and compression cycle is repeated.

NON - COMPRESSION (Unloaded): - When the air pressure in the reservoir reaches the high pressure setting of the governor, the governor opens, allowing air to pass from the reservoir through the governor and into the cavity beneath the unloader pistons. This lifts the unloader pistons and plungers. The plungers move up and hold the inlet valves off their seats.

With the inlet valves held off their seats by the unloader pistons and plungers, air is merely pumped back and forth between the two cylinders. When air is used from the reservoir and the pressure drops to low pressure setting of the governor, the governor closes and in doing so exhausts the air from beneath the unloader pistons. The unloader saddle spring forces the saddle, pistons and plungers down and the inlet valves return to their seats. Compression is then resumed.

MAINTENANCE

Every 35,000 miles, remove compressor discharge valve cap nuts and check for presence of excessive carbon deposits. Also, check the discharge line for carbon. If excessive carbon is found in either check, the cylinder head or discharge line should be cleaned or replaced.

Every 100,000 miles, depending upon operating conditions and experience, disassemble compressor, clean and inspect all parts thoroughly. Repair or replace all worn or damaged parts or replace compressor with a factory reconditioned, repair-exchange unit.

CAUTION: Should it be necessary to drain the engine cooling system to prevent damage from freezing, the compressor must be drained as both cylinder block and cylinder head are water cooled.

OPERATING

If the compressor fails to maintain adequate air pressure in the air system, it usually denotes loss of efficiency because of wear, provided leakage in the air system is not excessive. Oil passing is another sign of excessive wear.

Leakage past the discharge valves can be detected by removing the discharge line, applying shop air back through the discharge port and listening for escaping air. Also the discharge valves and unloader pistons can be checked for leakage by building up the air system until the governor cuts out, then stopping the engine. With the engine stopped, carefully listen for escaping air at the intake. To pinpoint leakage if noted, squirt soapy water around the unloader pistons. If there is no noticeable leakage at the unloader pistons, the discharge valves may be leaking.

If the compressor does not function as described above, or leakage is excessive, it is recommended that it be exchanged for a factory rebuilt compressor under the repair exchange plan. If this is not possible, the compressor can be repaired as described.

REMOVAL AND INSTALLATION

Drain air brake system. Drain engine cooling system and compressor block. Disconnect all air lines, water and oil lines to and from compressor. Remove compressor mounting bolts and compressor from engine. Use a gear-puller to remove the gear from compressor crankshaft.

Before re-installation, clean oil supply line. Before connecting this line to the compressor run the engine briefly to be sure oil is flowing freely through

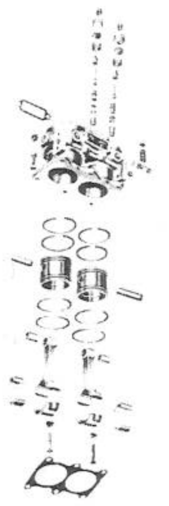


Figure 4 - 4: Block & Pistons

the supply line.

Clean the oil return line passages through the brackets; these passages must be unrestricted so oil can return to the engine.

Prelubricate compressor cylinder walls and bearings with clean engine oil before assembling compressor.

Always use a new mounting gasket and be sure oil hole in gasket and compressor is properly aligned with oil return port.

Inspect drive coupling and associated parts for wear or damage. They must be a neat fit on compressor crankshaft. Replace drive coupling if worn or damaged.

Install drive coupling on compressor crankshaft making sure it properly contacts the shaft and does not ride the key. Tighten crankshaft nut securely and install cotter pin.

Be sure the air cleaner is clean and properly installed. Compressor intake connections must be tight with no leakage.

Clean or replace any damaged or dirty air or water lines which may be corroded, before connecting them to the compressor. Use a new discharge flange fitting gasket.

Tighten mounting bolts securely and evenly. After installation run compressor and check for air, oil, or water leaks at compressor connections. Also check for noisy operation.

DISASSEMBLY

Clean compressor exterior of road dirt and grease using a good cleaning solvent.

Before compressor is completely disassembled the following items should be marked to show their relationship when the compressor is assembled: The cylinder block in relation to crankcase; end covers relation to crankcase; position of crankshaft in relation to crankcase; the cylinder head's relation to the block.

Refer to Figure 4 - 3. Remove cap screws and lift off cylinder head. It may have to be tapped with a rawhide hammer to break gasket joint.

Remove inlet valve springs from head and inlet valves from their guides in the block. Scrape off cylinder head gasket from cylinder head and block. Remove discharge valve cap nuts and lift out discharge valve springs and valves.

The discharge valve seats can be removed, but it is not necessary unless they are badly worn or nicked.

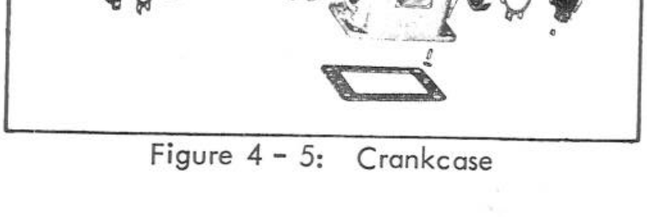


Figure 4 - 5: Crankcase

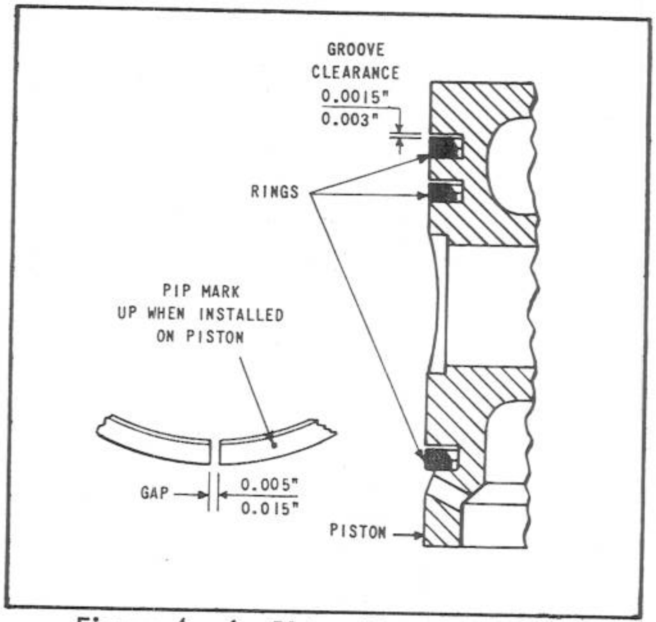


Figure 4 - 6: Piston Fits & Tolerances

ROD ASSEMBLIES (Figure 4 - 4): Straighten prongs of connecting rod bolt lockwashers and remove bolts, lockwashers and bearing caps. Push piston with connecting rods attached out the top of the cylinder block. Replace bearing caps on their respective connecting rods. Remove piston rings from pistons.

To remove pistons from connecting rods, remove wrist pin lockwire and press wrist pins from pistons and connecting rods. If connecting rods are aluminum, do not re-use, but replace with new die cast aluminum rods; steel connecting rods can be re-used and re-bushed if necessary. Remove cap screws securing end cover at drive end of crankshaft.

CRANKCASE (Figure 4 - 5): Remove end cover with oil seal, remove end cover gasket. Replace oil seal after cleaning end cover.

Remove cap screws that hold opposite end cover to crankcase; remove end cover and its gasket. Press the crankshaft and ball bearings from the crankcase then press ball bearings from crankshaft.

BLOCK (Figure 4 - 4): If compressor is fitted with an air strainer, inlet elbow or governor, remove same. Remove cap screws securing cylinder block to crankcase; separate crankcase and cylinder block and scrape off gasket.

Remove unloader spring, spring saddle and spring seat from cylinder block. Remove unloader guides and plungers and with the use of shop air blow unloader pistons out of cylinder block unloader piston bores.

Remove inlet valve guides; inlet valve seats can be removed but only if they are worn or damaged and are being replaced. Unloader bore bushings should be inspected but not removed unless they are damaged.

Check fit of wrist pins on pistons and connecting rod bushings. Wrist pin should be a light press fit in pistons. If wrist pin is a loose fit, the pin, piston, or both should be replaced. Check fit of wrist pin in connecting rod bushing by rocking the piston. This clearance should not exceed 0.0015'' Replace wrist pin bushing if excess clearance is found. Wrist pin bushings should be reamed after being pressed into connecting rods. Replace used wrist pin lockwires. Always replace die cast aluminum rods with new ones.

Check fit of piston rings in piston ring grooves. Check ring gap with rings installed in cylinder bores. Refer to Figure 4 - 6 for correct gap and groove clearance.

Check crankshaft screw threads, keyways, tapered ends and all machined and ground surfaces for wear, scores, or damage. Crankshaft journals which are out of round more than 0.001" must be reground. Bearing inserts are available in 0.010", 0.020", and 0.030" undersizes for reground crankshafts. Main bearing journals must be maintained so bearings are snug fit. The oil seal ring groove or grooves in crankshafts fitted with oil rings must not be worn. The ring groove walls must have a good finish and they must be square. Check to be sure the oil passages are open and clean through the crankshaft.

Check connecting rod bearings on crankshaft journals for proper fit. Used bearing inserts should be replaced. Connecting rod caps are not interchangeable. The locking slots of the connecting rod and cap should be positioned adjacent to each other.

Clearance between the connecting rod journal and the connecting rod bearing must not be less than 0.003" or more than 0.0021" after rebuilding.

Check for wear or flat spots. If found, bearings should be replaced. If type with sleeve bearing, this bearing should be checked for scores and wear and replaced if necessary.

Used unloader mechanism can be replaced by unloader kit MCI Part No. 4C-7-30.

The new unloader pistons should be a loose sliding fit in the unloader piston bores of the cylinder block.

REPAIRS

DISCHARGE VALVES & SEATS: If discharge valve seats merely show signs of slight wear, they can be dressed by using a lapping stone, grinding compound and grinding tool. Install new discharge valves, valve springs, and cap nuts. The discharge valve travel should be between .030'' and .046''.

To test for leakage by the discharge valves apply about 100 pounds of air pressure through the cylinder head discharge port and apply soap suds at the discharge valves and seats.

If excessive leakage is found, leave the air pressure applied, and with the use of a fibre or hardwood dowel and hammer, tap the discharge valves off their seats several times. This will help the valves to seat and should reduce any leakage.

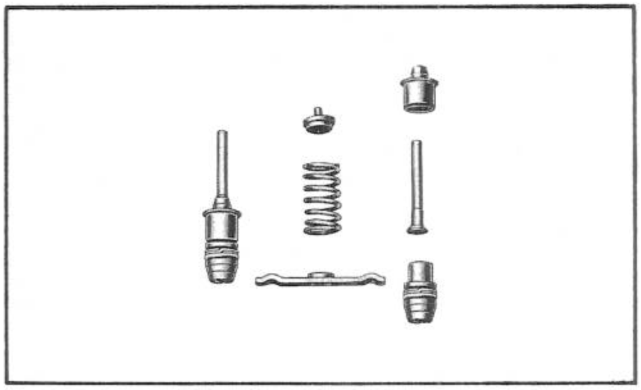


Figure 4 - 7: Unloader Mechanism

With air pressure still applied at the discharge port of the cylinder head, check for leakage at the discharge valve cap nuts. No leakage is permissible.

INLET VALVES AND SEATS: If inlet valve seats show sign of slight nicks or scratches, they can be redressed with a fine piece of emery cloth or by lapping with a lapping stone, grinding compound and grinding tool. If the seats are excessively damaged to the extent that they cannot be reclaimed, they should be replaced. The dimension from the top of the cylinder block to the inlet valve seat should not exceed 0.145" nor be less than 0.101".

Slightly worn or scratched inlet valves can be reclaimed by lapping them on a piece of fine crocus cloth on a flat surface, but it is suggested that new inlet valves be installed.

ASSEMBLY

INSTALLING CYLINDER BLOCK: Position cylinder block gasket and block on crankcase according to markings made prior to disassembly. Using cap screws with lockwashers, secure cylinder block to crankcase.

INSTALLING CRANKSHAFT: If the crankshaft is fitted with oil seal rings, install rings. Position ball bearings and crankshaft in crankcase making sure the drive end of the crankshaft is positioned as marked before disassembly.

If one end of the crankcase is counterbored for holding a bearing, be sure the crank shaft is installed through the correct end of the crankcase.

Carefully press crankshaft and bearings into crankcase using arbor press.

Position a new rear end cover gasket over the rear end of the crankcase making sure the oil hole in the gasket lines up with the oil hole in the crankcase. Position end cover with oil seal ring installed over crankcase and end cover gasket. The end cover should be positioned correctly in relation to the oil holes in the gasket and crankcase. Secure end cover to crankcase with cap screws and lockwashers.

If the opposite end cover requires an oil seal which was removed on disassembly, a new seal should be pressed into end cover. Position new end cover gasket and carefully install end cover over crankshaft and to crankcase avoiding damage to the seal. Secure end cover with cap screw and lockwashers.

PISTONS AND CONNECTING RODS: If rods are steel, they can be re-used and serviced as follows. However, it is recommended that the aluminum die cast rods not be re-used but replaced with new ones when re-building compressor. Do not re-use aluminum die cast connecting rods. If new wrist pin bushings are to be used, they should be pressed into the connecting rods so that the oil hole in the bushing lines up with the one in the rod. The new bushings should then be reamed or honed to provide between 0.0001" and 0.0006" clearance on the wrist pin. Position connecting rod in piston and press in wrist pin so that lockwire hole in the pin aligns with that of the piston. Install new lockwire through piston and wrist pin and lock same by snapping short end into lockwire hole at the bottom of the piston.

Install piston rings in correct location with ring pipmarks up (Figure 4 - 6). Stagger the position of the ring gaps.

Prelubricate piston, piston rings, wrist pin and connecting rod bearings with clean engine oil before installing them in the compressor.

Remove connecting bolts and bearing cap from one connecting rod. NOTE: it is important that caps and rods are not intermixed. Turn crankshaft so one of its connecting rod journals is in the downward, center position. Insert the connecting rod with piston through the top of the cylinder whose journal is down. Position and attach the bearing cap to the connecting rod making sure the bolt lockwashers are properly positioned on the cap. Tighten connecting rod bolts evenly and bend the two new lockwasher prongs up against the hex head of the bolt. Install the other connecting rod and piston in the same manner.

UNLOADER MECHANISM: The unloader pistons and their bores must be lubricated with special lubricant (dimethyl polysiloxane) prior to installation. If new unloader kits are being installed, the pistons in the kit are already lubricated.

Install the unloader pistons in their bores with caution against cutting the grommets or distorting the back-up rings. Position unloader plungers in their guides and slip them in and over the tops of the pistons.

Install the unloader spring seat in the cylinder block; a small hole is drilled in the block for this purpose. Position the saddle between unloader piston guides so its forks are centered on the guides. Install the unloader spring making sure it seats over the spring seats both in the block and on the saddle.

Install inlet valve seats if they have been previously removed. Position and install inlet valve guides, then drop inlet valves in their guides. There should be a loose sliding fit between guides and valves.

CYLINDER HEAD ASSEMBLY: If previously removed, the discharge valve seats should be installed. Drop discharge valves into their seats. Install discharge valve springs and cap nuts.

Place the inlet valve springs in the cylinder head. Use a small quantity of grease to hold them in place, just enough grease to keep the springs from falling out. Place cylinder head gasket on cylinder block. Carefully align cylinder head assembly on block and install cap screws with lockwashers. Tighten securely and evenly cap screws that hold cylinder head to block.

GOVERNOR (TYPE D-2)

DESCRIPTION

The governor, operating in conjunction with the compressor unloading mechanism, automatically controls the air pressure in the air brake or air supply system between the desired, predetermined maximum and minimum pressures. The compressor runs continually while the engine runs, but the actual compression of air is controlled by the governor which stops or starts compression when the maximum reservoir pressures are reached. The D-2 governor has a piston upon which air pressure acts to overcome the pressure setting spring and controls the inlet and exhaust valve to either admit or exhaust air to or from the compressor unloading mechanism.

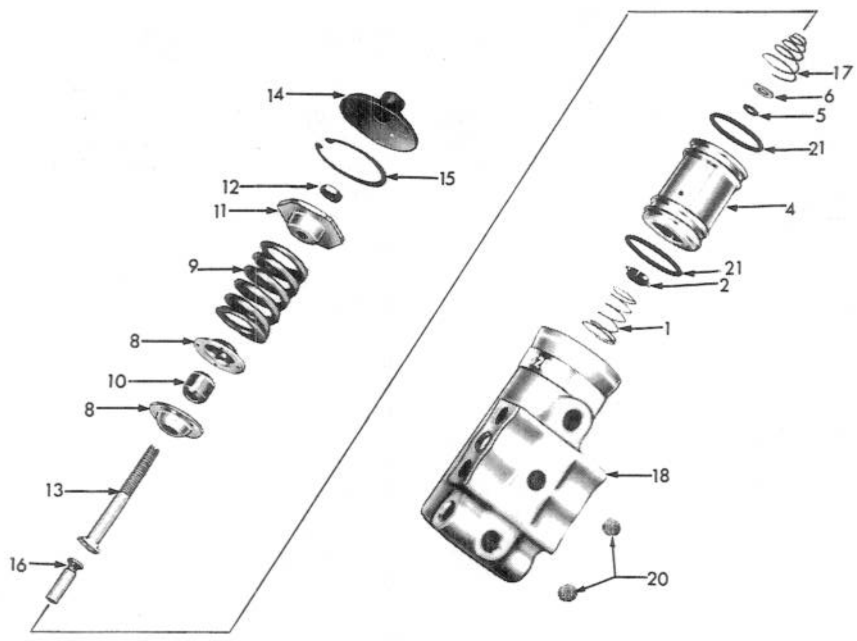
OPERATION

Reservoir air pressure enters the D-2 Governor at its reservoir port and acts on the area of the piston and beneath the inlet and exhaust valve. As the air pressure builds up the piston moves against the resistance of the pressure setting spring. The piston and inlet and exhaust valve move up when the reservoir air pressure reaches the cut-out setting of the governor. The exhaust stem seats on the inlet and exhaust valve and then the inlet passage opens. Reservoir air pressure then flows by the open inlet valve, through the passage in the piston and out the unloader port to the compressor unloading mechanism. The air, besides flowing to the compressor unloading mechanism, also flows around the piston and acts on the additional area of the piston. This additive force which results from a larger area on the piston assures a positive action and fully opens the inlet valve.

As the system reservoir air pressure drops to the cut-in setting of the governor, the force exerted by the air pressure on the piston will be reduced so that the pressure setting spring will move the piston down. The inlet valve will close and the exhaust will open. With the exhaust open, the air in the unloader line will escape back through the piston, through the exhaust stem and out the exhaust port.

MAINTENANCE

After 15,000 miles, clean or replace governor filters. If cleaning, use a cleaning solvent which is known to have no detrimental effect on metal or rubber material. If filters are removed they should



1.	Valve Spring
2.	Valve
4.	Piston
5.	Grommet
6.	Washer
8.	Spring Seat - Lower
9.	Spring
10.	Spring Guide
11.	Spring Seat - Upper
12.	Nut
13.	Adjusting Screw
14.	Cover
15.	Retaining Ring
16.	Stem - Exhaust
17.	Spring - Exhaust Stem
18.	Body
20.	Filter
21.	Grommet
22.	Pipe Plug

Figure 4 - 9: Governor

be replaced with new filters.

After 100,000 miles, disassemble the governor and clean and inspect all parts.

SERVICE CHECKS OPERATING TEST

Start engine and build up air pressure in the air system and check the pressure registered by the dash or test gauge at the time the governor cuts out, stopping the compression of air by the compressor. The cut-out pressure should be 115 p.s.i.

With the engine still running, make a series of brake applications to reduce the air pressure and observe at what pressure the governor cuts-in the compressor. As in the case of the cut-out pressure, the cut-in pressure should be 95 p.s.i. Never condemn or adjust the governor pressure settings unless they are checked with an accurate test gauge or a dash gauge that is registering accurately. If the pressure settings of the governor are inaccurate or it it is necessary that they be changed, the procedure is as follows:

First unscrew the cover at the top of the governor. Next, loosen the adjusting screw locknut. With a screwdriver the adjusting screw is turned counterclockwise to raise the pressure settings and the screw is turned clockwise to lower the pressure setting. After the adjustment is completed, the adjusting screw locknut should be tightened to lock this adjustment.

LEAKAGE TEST

Leakage checks on the governor are made at its exhaust port in both cut-in and cut-out positions. In the cut-in position, check exhaust port for inlet valve leakage by applying a soap solution at the port. Leakage could also be past the bottom piston grommet. In the cut-out position check the exhaust port to determine leakage at the exhaust valve seat or stem grommet. In this position leakage could also be past the upper piston grommet.

REMOVAL AND INSTALLATION

Applying parking brake.

Drain air brake system and disconnect reservoir air line.

Remove governor mounting bolts, then governor.

Clean mounting pad on both compressor and governor block. Clean connecting line, or lines. Also be sure compressor unloading port is clear and clean.

Install governor using a new governor mounting gasket. Connect air lines to governor. Test governor as outlined earlier.

DISASSEMBLY

Clean governor exterior of road dirt and grease using a good cleaning solvent and brush.

Unscrew the top cover.

With a pair of retaining ring pliers, remove the spring assembly retaining ring.

Remove the adjusting screw and spring assembly.

Remove the locknut, then the hex-shaped upper spring seat from the adjusting screw.

Remove the pressure setting spring, lower spring seat, spring guide and the other lower spring seat from the adjusting screw.

Remove the exhaust stem and its spring from the top of the piston.

With the body in the inverted position, tap it lightly and the piston should fall out.

Remove the inlet and exhaust valve spring and the valve from the piston.

Remove the two piston grommets and with a hooked wire remove the exhaust stem grommet.

Clean or remove the unloader and reservoir port filters.

CLEANING AND INSPECTION

Clean all metal parts in a good cleaning solvent.

Wipe rubber parts dry.

Inspect body for cracks or other damage. Be particularly careful that all passages in the body, filters, exhaust stem, and the piston are not obstructed.

Check springs for cracks, distortion, or corrosion.

Replace all parts not considered serviceable during these inspections.

REASSEMBLY

Prior to reassembly lubricate the lower body bore, the top of the piston, the piston grooves, piston grommets, piston setting spring guide and the adjustable screw with recommended lubricant, M.C.I. Part No. 4A-15-113.

Install the exhaust stem grommet in its groove in the stem bore of the piston.

Drop the inlet and exhaust valve into place at the bottom of the piston.

Install the inlet valve spring with its narrow end against the valve. Press the spring down until the large coiled end snaps into the groove inside the piston.

Position the exhaust stem spring over the exhaust stem. Then carefully press the stem into the stem bore of the piston.

Install the piston in the body.

Install one lower spring seat, spring guide, the other lower spring seat, pressure setting spring, and the hex-shaped upper spring seat on the adjusting screw, in that order. Screw the upper spring seat down until the dimension from the top of the seat to the bottom of the stem head is approximately 1-7/8".

Install the lock nut.

Before placing the adjusting screw and stem assembly in the governor body, check to be sure the exhaust stem and its spring are in place in the piston.

Install the adjusting screw and spring assembly retaining ring.

At this point, make the adjustment as outlined under Service Checks Section.

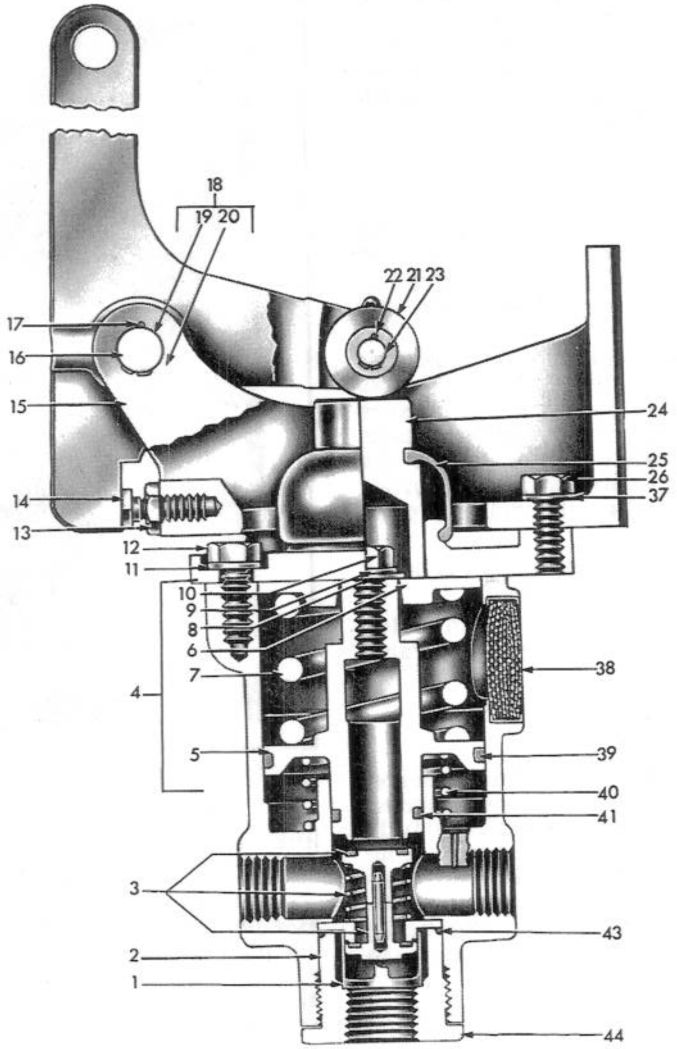
After the adjustment is made, then the top cover should be screwed on tightly until it seals the body against the entrance of any foreign matter.

If necessary, install new filters in the reservoir and unloader ports. These cup-shaped filters can be installed with the head of a pencil.

BRAKE APPLICATION VALVE

DESCRIPTION

The brake valve is the control unit of the air brake system. It provides the driver with an easily operated and graduated means of applying or releasing the vehicle brakes. The brake valve is operated through a lever with a linkage connection to a brake pedal. Movement of the brake pedal controls the amount of air pressure delivered to, or released from the vehicle brake actuators. To fully apply the brakes, the brake pedal must be fully depressed, whereas, when the brake pedal is only partially depressed, correspondingly less braking force is developed. In other words, the farther the driver depresses the brake pedal, the greater the air pressure delivered to the brake actuators. At any time the brakes of the vehicle may be partially released by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1. Inlet Valve Guide
2. Body
5. Piston
6. Graduating Spring Seat
7. Graduating Spring
8. Washer
9. Shakeproof Lockwasher
10. Cap Screw
11. Lockwasher
12. Cap Screw
13. Lock Nut
14. Adjusting Screw
15. Bushing
16. Pin
17. Cotter Pin
19. Bushing
20. Mounting Bracket
21. Roller
22. Cotter Pin
23. Pin
24. Plunger
25. Boot
26. Cap Screw
37. Lockwasher
38. Filter Screen
39. Grommet
40. Spring - Piston Return
41. Grommet
43. Grommet
44. Inlet Nut

Figure 4 - 10: E-1 Brake Valve

the driver permitting the brake pedal to partially return towards released position, or they may be entirely released by permitting the pedal to return to full released position. In this manner the amount of force being applied to the brakes of the vehicle is always under control of the driver.

MAINTENANCE

Every 5,000 miles, lubricate lever roller, also hinge pin and linkage with engine oil. Lift boot away from mounting plate and put a few drops of SAE 20 engine oil between mounting plate and plunger.

Lever type brake valve - check to be sure that with brakes fully applied the pedal contacts the pedal stop. With brakes released check to be sure that the lever arm on the brake valve contacts the stop button on the brake valve. Adjust the pedal linkage, if necessary, to provide for this. After any adjustment, check the brake valve delivery pressure.

Clean exhaust strainer often enough, depending on service conditions, to avoid restrictions.

Every 100,000 miles, disassemble brake valve and clean all parts. Install new inlet-exhaust valve and piston grommets.

OPERATING TESTS

Check the delivery pressure of the brake valve, using an accurate air pressure test gauge. Depress the brake pedal to several positions between fully released position and fully applied position and check to be sure the delivered air pressure registered by the test gauge varies in accordance with the position in which the pedal is held. The brake valve must control all delivery pressures between 5 and 75 pounds.

NOTE: To install test gauge, remove plug on left-hand side of brake valve.

LEAKAGE TEST

With the pedal fully released, coat the exhaust port with soap suds to check for leakage. No leakage is permissible. Make and hold a high pressure application. Coat the exhaust port and top of the valve with soap suds. No leakage is permissible. If the brake valve has excessive leakage, it is recommended that it be returned to the MCI Parts Division for a factory rebuilt valve. If this is not possible, the valve can be repaired with genuine parts which can be ordered through MCI Parts Manual.

REMOVAL AND INSTALLATION

Block or hold vehicle by means other than air brakes. Open drain cocks and exhaust air pressure from the air brake system. Disconnect air lines at brake valve. Disconnect pedal linkage. Remove mounting bolts and remove brake valve.

Clean air lines to brake valve. Mount brake valve and tighten mounting bolts. Connect pedal linkage. Connect air lines to valve. Test brake valve for service as outlined in "Service Checks" section.

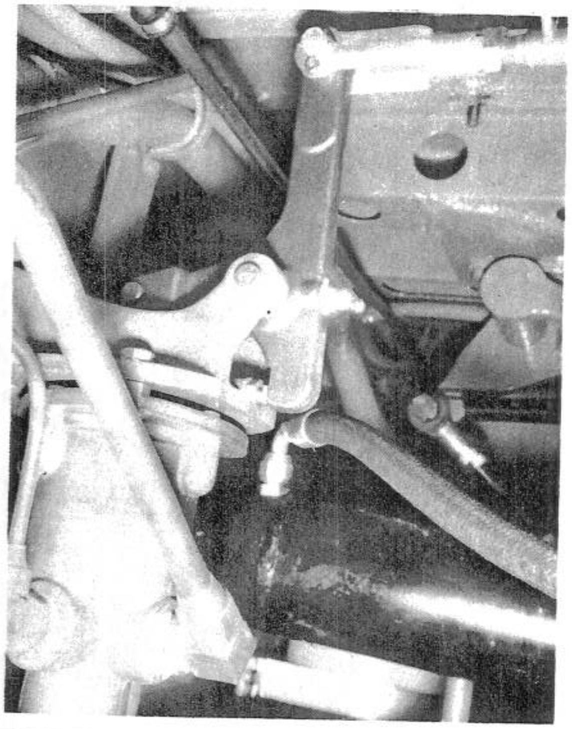


Figure 4 - 11: Brake Application Valve

Remove three mounting bolts. Remove and disassemble lever actuating mechanism. Lift off mounting plate. Remove piston and spring assembly from body. Remove rubber grommets from piston. Do not disassemble the pressure regulating spring and piston assembly unless the exhaust seat has been damaged and has to be replaced. Remove piston-return spring from body. Remove inlet cap nut from body. Remove inlet valve guide, inlet and exhaust valve assembly.

Wash all metal parts in cleaning solvent and dry. Wipe all rubber parts clean.

Carefully inspect the exhaust seat. If seat is worn slightly, lap on a piece of crocus cloth on a flat surface. If seat is worn excessively, or damaged in any way, the piston and pressure regulating spring assembly must be replaced. Inspect outside surfaces of piston which contacts bore in body of valve for scratches, nicks or out-of-round condition. Replace piston if necessary. If pressure regulating spring is damaged in any way, it must be replaced. Replace rubber grommets with new ones.

Check mounting plate for cracks or breakage. Replace if necessary. Replace boot if cracked or deteriorated. Inspect the body for scores and excessive wear where the piston contacts the body. If excessive wear or grooves are found, the body should be replaced. Inspect small bleed hole leading to piston cavity in body to be sure it is open and not obstructed. Replace inlet and exhaust valve assembly if valves or seats are worn or damaged.

REASSEMBLY

Install new grommets on piston. Lubricate the piston grommets, piston and piston bore with barium grease. Install piston return spring, piston and spring assembly in body. Install mounting plate and secure in place with the three cap screws and lockwashers.

Install inlet and exhaust valve assembly after positioning guide on the inlet valve seat. Place new grommet under inlet valve seat and install inlet cap nut.

ADJUSTMENT

If the brake valve does not release, it indicates that the exhaust valve is not opening sufficiently. This can be caused by:

1. Improper adjustment of the linkage or lever adjusting screw which would prevent the lever on the valve from returning to the fully released position. (refer to following illustration)
2. Lack of lubrication in the body causing the piston and spring assembly to bind.
3. Dirt or other foreign matter between the heel of the pedal and bracket.

If the brake valve does not apply promptly, or does not apply fully, it indicates that the inlet valve is not opening sufficiently.

QUICK RELEASE VALVES

DESCRIPTION

The quick-release valves speed up the release of air pressure from the brake chambers. When a brake valve application is released, the exhausts of the quick-release valves open and the air pressure accumulated in the brake chambers is exhausted through the two quick-release valves, rather than exhausting back through the brake valve.

A line from a delivery port of the brake valve is connected to the top port of each quick-release valve. The two side ports are for brake chamber connections and the bottom ports are the exhaust.

OPERATION

When a brake valve application is made, air pressure enters the top port of the quick-release valve, moves the diaphragm down, closing the exhaust port. At the same time this air pressure forces the edges of the diaphragm down and flows past into the brake chambers.

As soon as the brake chamber pressure beneath the diaphragm equals the air pressure being delivered by the brake valve, the diaphragm spring forces the outer edges of the diaphragm against the body seat. The exhaust port is still sealed by the center portion of the diaphragm. When the brake valve is released, air pressure above the diaphragm is exhausted. Now, the pressure under the diaphragm raises it and the exhaust port opens allowing brake chamber pressure to release.

MAINTENANCE

Every year or after 50,000 miles remove the quick-release valve, dismantle it and clean all parts. The diaphragm should be replaced if worn or deteriorated.

SERVICE CHECK

Make a brake valve application and note that the brake chambers served by the quick-release valve apply. Release the application and observe that the air pressure is quickly exhausted through the exhaust of the quick-release valve.

LEAKAGE TEST

Make and hold a brake valve application and check the exhaust port of the quick-release valve for leakage. If the quick-release valve does not function properly or leaks excessively, we recommend that it be exchanged for a factory reconditioned valve or repaired as outlined below.

REMOVAL AND INSTALLATION

Drain air brake system. Disconnect air lines from quick-release valve. Remove mounting bolts, and then valve.

To re-install mount quick-release valve with its exhaust port pointing down. Connect brake valve to top port and brake chamber lines to side ports. Make sure exhaust port is not restricted.

DISASSEMBLY AND REPAIR

Remove cover using wrench on square portion of exhaust port. Remove spring, spring seat and diaphragm.

Clean all parts in cleaning solvent. Inspect diaphragm, especially the lower part that contacts the exhaust seat, for wear or deterioration.

Check the cover exhaust seat for pitting or nicks. This seat should be smooth and sharp. If not, use a fine piece of emery cloth to dress the seat. Check the spring and spring seat for wear or corrosion. Clean or replace as necessary.

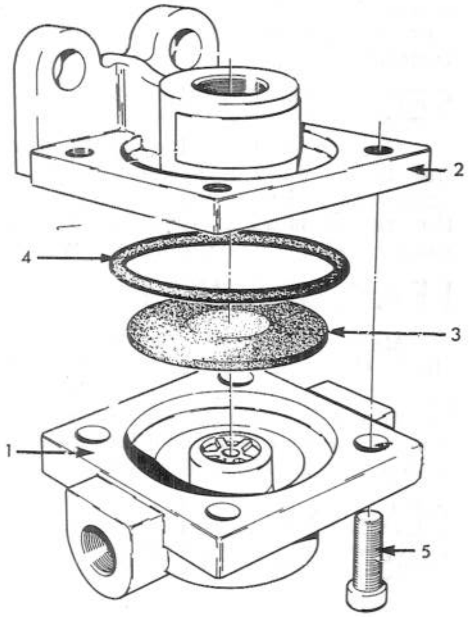
REASSEMBLY

Position the spring seat over the diaphragm and then both into the body. Position spring in place. Install cover and tighten securely.

REAR BRAKE RELAY VALVE

DESCRIPTION

The rear brake relay valve is mounted on the center of the rear baggage compartment bulkhead. Application and release of the rear brakes is made through the relay valve. A line from the air tank is connected directly to the valve providing high pressure air close to the rear brake chambers at all times. The relay valve is connected to the brake application valve by a small air line which delivers air pressure to the top of the relay valve. The relay valve provides a rapid application of rear brakes



1. Body
2. Cover
3. Diaphragm
4. Grommet
5. Cap Screw

Figure 4 - 13: Quick Release Valve

and acts as a quick release valve permitting rapid release of air pressure from the rear brake chambers.

SERVICEABILITY TESTS

OPERATING TEST: With air brake system fully charged, apply brakes and make sure rear wheel brakes apply promptly. Release brakes and make sure air pressure is quickly exhausted from exhaust port of the relay valve.

LEAKAGE TESTS

With brakes released, cover exhaust port with soap suds. Leakage in excess of a 1-inch bubble in one second is not permissible. Leakage is caused by inlet valve not seating properly. With brakes applied, cover exhaust port with soap suds. Leakage in excess of a 1-inch bubble in one second is not permissible. Leakage is caused by defective diaphragm or seat. If leakage is caused by diaphragm, both the diaphragm and diaphragm seat should be wiped clean with gasoline. If leakage is caused by the inlet valve, the valve and seat must be cleaned, or replaced with new parts.

REMOVAL AND INSTALLATION

Exhaust air pressure from system. Disconnect air lines from valve then remove valve assembly from vehicle. To install the relay valve, mount the valve on the bulkhead and tighten the mounting bolts firmly. Connect the air lines to the valve. Build up the air pressure in the system; then test the valve as previously directed under "Serviceability Tests".

DISASSEMBLY

Mark valve cover, diaphragm ring, and valve body so parts can be reassembled in same position. Remove six capscrews and lockwashers attaching valve cover to valve body. Remove cover, diaphragm, diaphragm ring, and diaphragm guide from valve body.

Remove four screws and lockwashers attaching guide cap to bottom of valve body. Remove valve cap and inlet valve assembly. Remove retaining ring and separate inlet valve, valve spring, and guide cap. Remove and discard O-rings.

Remove screw and lockwasher holding exhaust diaphragm in place. Remove diaphragm washer and exhaust diaphragm.

REPAIR

Thoroughly clean all parts in cleaning solvent. Examine diaphragms for cracking, stretching, or deterioration. Replace if not in good condition. Inspect the diaphragm seat at the top of the valve body. The seat must be smooth and free from scratches or corrosion. If only slightly scratched or corroded, the seat may be repaired by lapping on a flat surface covered with fine aluminum oxide abrasive cloth.

Examine the inlet valve and inlet valve seat. The rubber seating surface on inlet valve is bonded in place. If the valve or seat are scratched or worn, replace with new parts. Replace weak or damaged valve spring. The diaphragm guide bore in the valve body, and inlet valve bore in the guide cap should be smooth. If badly damaged, replace parts.

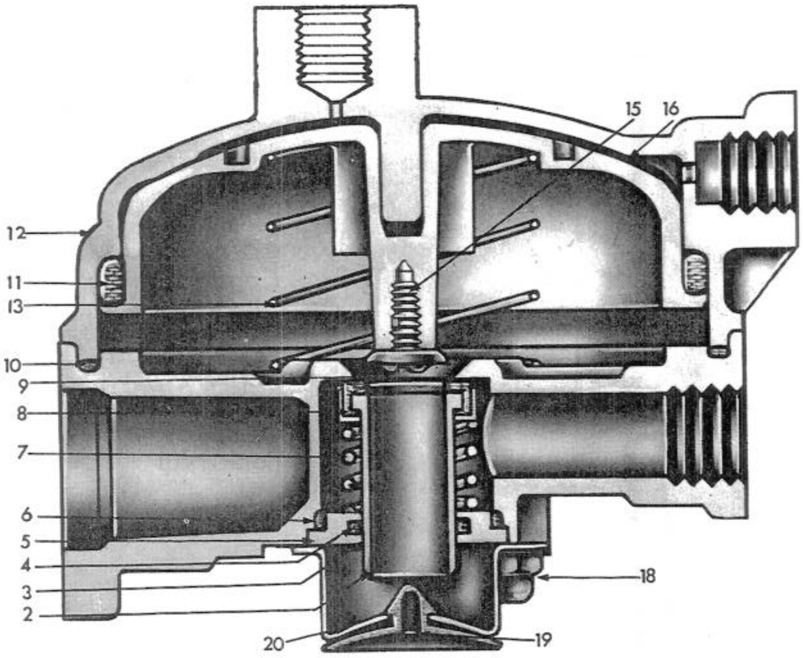


Figure 4 - 14: Rear Brake Relay Valve

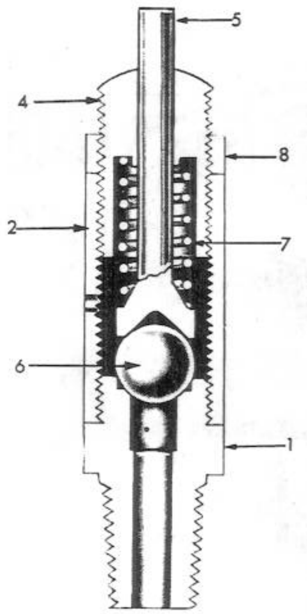
REASSEMBLY

Place new O-ring on guide cap and on inlet valve. Apply thin coat of Lubri-plate inside guide valve. Apply thin coat of Lubriplate inside guide cap, and body bores in contact with cap and with diaphragm guide. Insert spring and O-ring end of inlet valve in guide cap bore. Force inlet valve down into guide cap. Place retaining ring in cap groove and snap around narrow neck of inlet valve.

Insert inlet valve and cap assembly through bottom of relay valve body. Attach cap to body with four screws and lockwashers. Tighten firmly.

Place diaphragm guide over stem of inlet valve. Position diaphragm ring on body aligning match marks. Place diaphragm on ring, and align by-pass holes. Install cover aligning match marks. Parts should be aligned, without obstructing by-pass port. Install six capscrews and lockwashers and tighten to 50-70 inch-pounds torque.

Insert exhaust diaphragm and diaphragm washer (cupped away from diaphragm) in exhaust port. Install screw and lockwasher and tighten firmly.



1. Body
2. Cage - Spring
4. Nut - Adjusting
5. Pin - Release
6. Ball - Steel
7. Spring
8. Lock Nut

SAFETY VALVE

SAFETY VALVE

DESCRIPTION

The safety valve protects the air system against excessive air pressures above 150 pounds. The safety valve consists of a spring loaded ball check valve which lifts and permits air to exhaust to atmosphere if the pressure in the reservoir rises above its setting.

Should the reservoir pressure below the ball valve rise to a point above the setting of the safety valve, the force developed will overcome the force of the regulating spring holding the ball on its seat and the ball will lift. This permits air to pass up into the spring cage and exhaust through the exhaust port. As soon as this reduces the pressure to the setting of the safety valve, the regulating spring forces the ball back on its seat stopping the exhaust. Normally, the safety valve remains inoperative and only functions if for any reason the reservoir pressure rises above its normal limit.

MAINTENANCE

Every 50,000 miles the safety valve should be removed and thoroughly cleaned.

TEST

The safety valve may be tested to be sure it is operative by pulling the exposed end of the valve stem. This removes the spring load from the ball and permits the valve to exhaust. If the safety valve does not "blow off" when this is done, the ball is stuck on its seat. The complete valve should be removed and dismantled for cleaning.

Leakage at the exhaust port in the spring cage should not exceed a three inch soap bubble in three seconds.

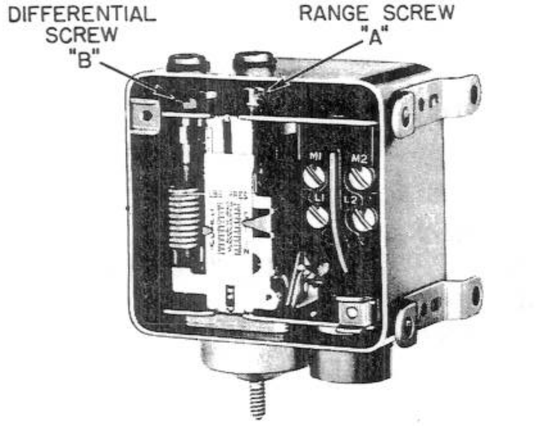
DISASSEMBLY AND REPAIR

Unscrew the spring cage from the body of the safety valve. Lift ball valve from body and remove spring, spring seat, and release pin from spring cage.

Clean all parts in cleaning solvent. Examine the ball valve for signs of pitting or scratches. If the ball valve cannot be reconditioned, it should be replaced. Check the body and spring cage for cracks. Be sure the exhaust port in the spring cage is not plugged.

REASSEMBLY

Place the ball valve in the body of safety valve. Place spring release pin and spring seat in spring cage with the adjusting screw assembly. Position the spring seat over the ball valve and screw the spring cage to the body.



Interior view of single function control. Refer to "adjustments" for adjustment instructions.

FIGURE 4-15: Low Pressure Indicator Switch

LOW AIR WARNING LIGHT SWITCH

DESCRIPTION

The switch has two sets of contacts; one being L1 and M1 controlling the low air warming circuit. The L2 and M2 contacts control the field relay circuit. The control is necessary to prevent the generator from being loaded when there is insufficient air in the belt tension air cylinder.

OPERATION

Operation of the low air warning light switch may be checked by reducing the reservoir pressure and being sure that the contacts close when the reservoir pressure is 60 pounds. The contacts L1 and M1 will be closed when the warning light and buzzer operate.

ADJUSTMENTS

Control cover should be removed when making adjustments to permit viewing direct reading scale plates.

Gasketed screws in control case can be removed for screwdriver adjustment or adjustment can be made with a service wrench without removing gasketed screws.

Range adjusting screw "A", should first be set so tell-tale light goes out at 70 P.S.I. This is the cut-in point. Both cut-in and cut-out settings are changed a like amount. Turning screw "A" clockwise increases control setting.

Differential adjusting screw "B" changes differential setting only. Turning screw "B" clockwise increases (widens) the differential. This differential should be 10 P.S.I. so that the tell-tale light goes on at 60 P.S.I.

AIR LINE CHECK VALVES

DESCRIPTION

The in-line check valve is a device placed in an air line to allow air flow in one direction only and to prevent flow of air in the reverse direction.

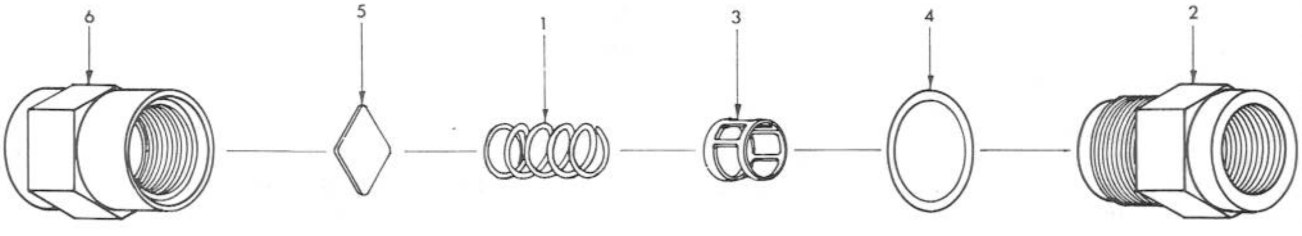
An arrow indicating the direction of air flow is cast into the body of the valve.

OPERATION

Air flow in the normal direction moves the disc valve from its seat and the flow is unobstructed. Flow in the reverse direction is prevented by the seating of the disc valve.

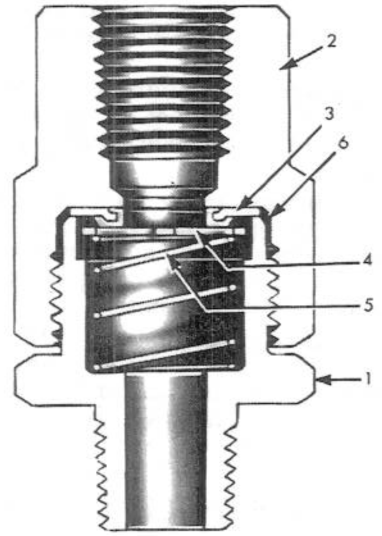
MAINTENANCE

Every six months, 1,800 operating hours or every 50,000 miles, disassemble, clean and inspect all parts.



1. Spring
2. Body
3. Valve Stop Bushing
4. Grommet
5. Discharge Valve
6. Cap Nut

Figure 4-16: Main Air Supply Check Valve



1. Cover
2. Seal
3. Retainer - Spring (Valve)
4. Spring
5. Body
6. "O" Ring

Figure 4-17: Air Line Check Valve

Replace any parts showing signs of wear or deterioration. Reassemble and check for proper operation.

OPERATING AND LEAKAGE CHECK

NOTE: Depending upon installation, it may be easier or necessary to completely remove check valve so that the following checks may be made. With air pressure present at outlet side of check valve and the inlet side open to atmosphere, coat the open end of the check valve with soap suds; a bubble leakage is permitted.

If the check valve leaks excessively, the valve should be replaced with a new check valve or repaired with genuine parts.

REMOVAL AND INSTALLATION

Apply parking brakes. Completely drain all reservoirs. Disconnect air lines and plug ends to prevent any foreign particles from entering the system. Check and, if necessary, clean or replace air lines to valve. Install valve making certain that it is installed correctly with respect to the desired air flow. An arrow indicating the direction of air flow is cast into the body of the valve.

DISASSEMBLY

Unscrew cap nut from body and remove gasket. Remove shims (if present), disc valve, valve seat (if present) spring, and valve stop bushing (if present).

CLEANING AND INSPECTION

1. Wash all metal parts in a good cleaning solvent.
2. Rubber parts should be wiped clean.
3. Inspect disc valve and seat for signs of wear or deterioration.
4. Check spring for cracks, corrosion or distortion.
5. Inspect body and cap nut for cracks or damage.
6. Replace all parts that are damaged or worn.

ASSEMBLY

Position parts in proper order in body. Install new grommet on cap nut. Screw cap nut into body and tighten securely.

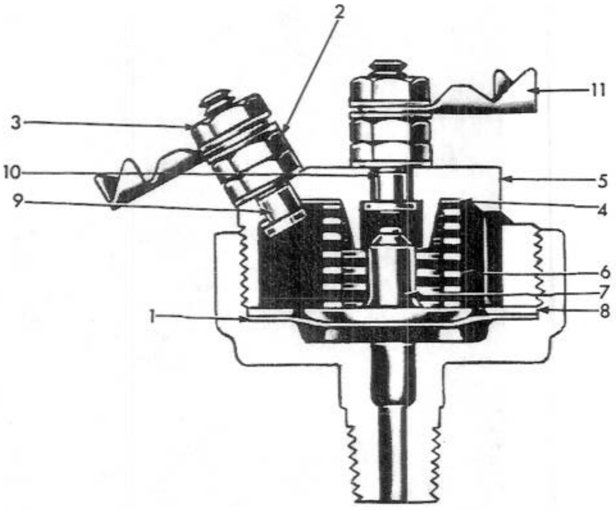
NOTE: Care should be taken that disc valve is not lodged between cap nut and body when assembling.

STOP LIGHT SWITCH

DESCRIPTION

The stop light switch operates in conjunction with the brake valve and stop light by completing the stop light electrical circuit when a brake application is made.

When air pressure from the brake valve enters the cavity on the side of the diaphragm, the dia-



1. Diaphragm
2. Washer
3. Nut
4. Terminal Connector
5. Cover
6. Spring
7. Plunger
8. Washer
9. Terminal Screw
10. Terminal Screw
11. Terminal Cable

Figure 4-18: Stop Light Switch

phragm changes its position, overcoming the force of the spring and moving the contact plunger until the electrical contacts close. This closes the stop light circuit. When the air pressure acting on the diaphragm is exhausted by the brake valve, the spring forces the diaphragm and the contact plunger back to their normal position and the stop light circuit is opened.

MAINTENANCE

Every 10,000 miles, check electrical connections.

Every 50,000 miles, disassemble the stop light switch and clean all parts. Replace diaphragm.

TEST

Apply the brake valve and note that with the first downward movement of the brake valve pedal or treadle, the stop light immediately lights. Release the brake valve and note that the stop light goes "off". With the brakes applied, no leakage is permitted at the stop light switch.

REMOVAL AND INSTALLATION

To remove the stop light switch disconnect electrical connections at the stop light switch. Remove the stop light switch mounting bolts and remove the valve.

REPAIR

Remove the cover from the body and lift out the spring contact plunger, diaphragm ring, and diaphragm.

Clean all metal parts in cleaning solvent. Examine diaphragm. If diaphragm is cracked, worn, or damaged, replace with new diaphragm. Inspect the contact points for signs of pitting or wear. If pitting is not too severe, the contacts may be reconditioned by filing them with a fine file such as is used for distributor points. If they cannot be reconditioned, they should be replaced. Check the spring for tension. If it has lost its tension, it should be replaced. If the body or cover are cracked or damaged, they should be replaced.

To reassemble, place the diaphragm on the body. Position contact plunger on the diaphragm. Attach the cover to the body.

RESERVOIRS

DESCRIPTION

A reservoir is a storage tank. The function of a reservoir is to provide a place to store compressed air so there will always be an ample supply available for immediate use in the air system.

A total of four air reservoirs are used on the coach; two are used in the service brake system, one in the park brake system; one in the accessory air suspension system.

OPERATION

A reservoir has no moving internal parts. The reservoir provides a place where condensation may collect. All compressors pass a certain amount of oil in order to lubricate the cylinder walls and piston rings. Also, depending on the humidity, the atmosphere entering the compressor contains a certain amount of water. This oil and water normally passes into the reservoir in the form of vapor because of the heat generated during the compression. After reaching the reservoir, the vapor cools and condenses in the form of an oil and water emulsion and is drained by a drain cock at bottom of reservoir.

MAINTENANCE

Reservoirs do not require any maintenance, except checked for mounting, outside corrosion or damaged lines and fittings.

FRONT AND REAR TRAILING WHEEL BRAKE CHAMBERS

DESCRIPTION

Brake chambers used at the front axle and rear trailing wheels are identical in construction.

Brake chambers convert compressed air pressure into mechanical force and movement which applies the vehicle brakes. Front brake chambers are of the clamp ring type. The diaphragm is held between the two plates by a clamping ring, two nuts and two bolts.

Air pressure enters the pressure side of the brake chamber and forces against the diaphragm which in turn moves the push rod assembly forward. The push rod is connected to a slack adjuster which is attached to the cam shaft that rotates the brake cam and applies the brakes.

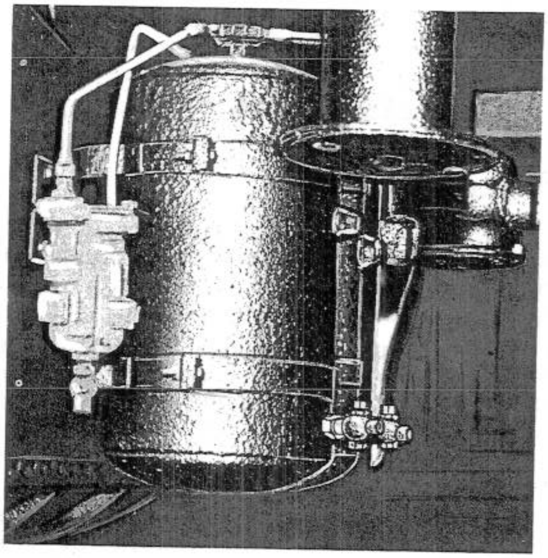


Figure 4-19: Dry & Park Brake Reservoir

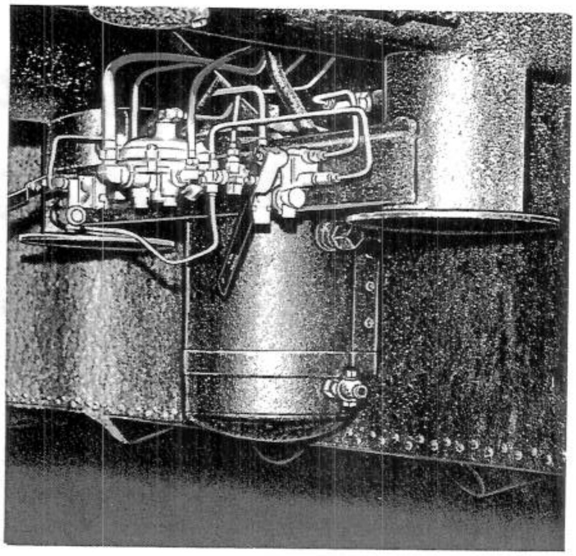


Figure 4-20: Wet Reservoir

When air pressure is released from the brake chamber, the push rod return spring in combination with the brake shoe return spring returns the diaphragm, push rod, slack adjuster and brake cam to their released positions, releasing the brakes.

MAINTENANCE

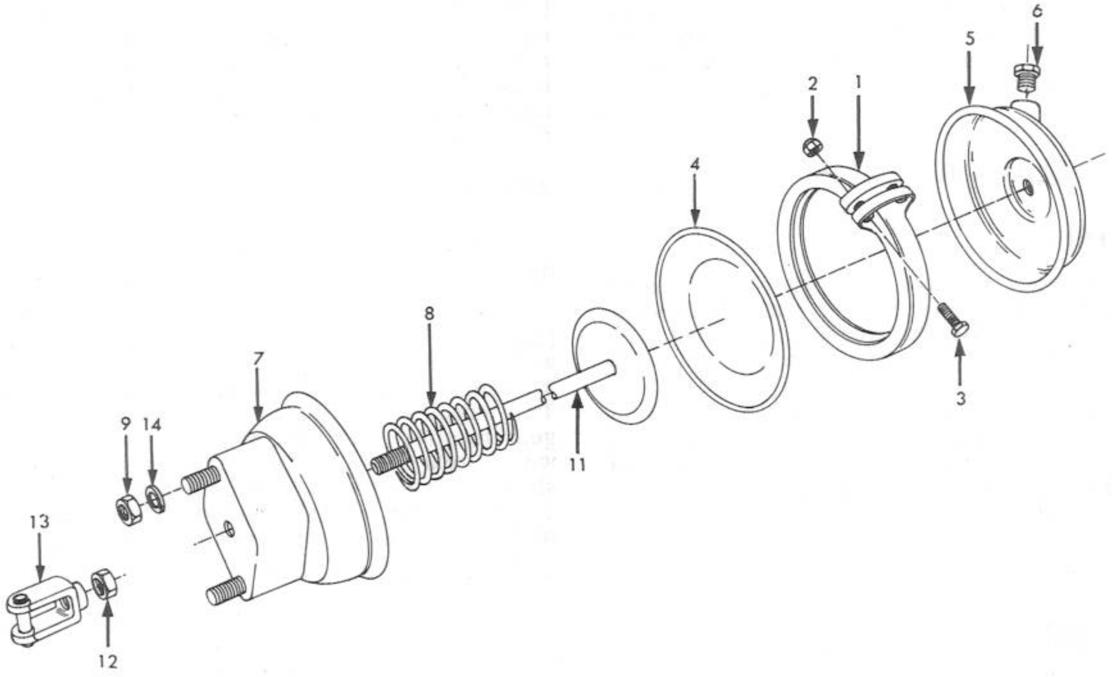
Every 2,000 miles depending on type of operation, check brake chamber push rod travel and adjust if plunger stroke exceeds 1¾". Push rod travel should be kept as short as possible without brakes dragging. Excessive push rod travel shortens diaphragm life. gives slow braking response and wastes air.

Check push rod to slack adjuster alignment in both the applied and released positions to be sure the push rod moves out and returns properly and without binding. Also check the angle formed by the slack adjuster arm and push rod. It should be 90° or greater when the chamber is in the applied or released positions.

Every 50,000 miles, depending on the type of operation, disassemble brake chamber and clean all parts. Install new diaphragm, or any other rubber parts, if they are worn or deteriorated. When the diaphragm or spring, or both, are replaced, they should also be replaced in the corresponding brake chamber on the same axle.

OPERATING AND LEAKAGE

Make a brake application and check that the brake chamber push rod moves out promptly without binding. Release the application and note that the push rod returns to the released position promptly and without binding. Check push rod travel to be sure it is at a minimum without brakes dragging.



1.	Ring - Clamp	8.	Spring
2.	Nut	9.	Nut
3.	Bolt	11.	Push Rod Assy.
4.	Diaphragm	12.	Nut
5.	Pressure Plate	13.	Yoke
6.	Plug	14.	Lockwasher
7.	Non-Pressure Plate Assy.		

Figure 4-21: Front & Rear Trailing Wheel Brake Chambers

With a full pressure application, check the brake chamber for leakage. No leakage is permissible. If leakage is detected around the flange, or clamping ring, the bolts should be tightened evenly but only enough to stop the leakage otherwise the diaphragm, flange sealing surface or clamping ring could be distorted.

REMOVAL AND INSTALLATION

Disconnect air line and push rod yoke. Remove brake chamber.

Mount brake chamber to mounting bracket. Install yoke and its lock nut on push rod and connect to slack adjuster arm. Check the angle formed by the push rod and slack adjuster. The angle should never be less than 90° when full air pressure is applied to the brake chamber when the brakes are cold and properly adjusted.

DISASSEMBLY AND REPAIR

After cleaning the exterior of the brake chamber, mark parts in such a way that they can be assembled the same way. If the brake chamber is to be dismantled on the vehicle, for axample to change the diaphragm or spring, first back off the slack adjuster to relieve the return spring pressure against the pressure plate, then follow disassembly procedure below.

Pull out push rod and clamp it at the non-pressure plate with vise or vise grip pliers. If necessary, use air pressure to move the push rod out. Grips of vise or vise grip pliers should be covered or taped to prevent damage to the push rod. Remove clamp ring nuts and bolts. Spread clamp ring slightly, just enough to slip it off the plates. It is sometimes necessary to use a screw driver and gradually pry under the clamp ring to remove it. If the clamp ring is to be reused, caution should be taken against bending it out of shape.

Remove pressure plate and diaphragm. Remove yoke and lock nut from push rod. Release grip on push rod. Remove push rod assembly, spring and other details.

Clean all metal parts and inspect for damage. Damaged parts should be replaced. If it is necessary to replace the return spring, be sure the correct replacement spring is used.

SLACK ADJUSTERS

DESCRIPTION

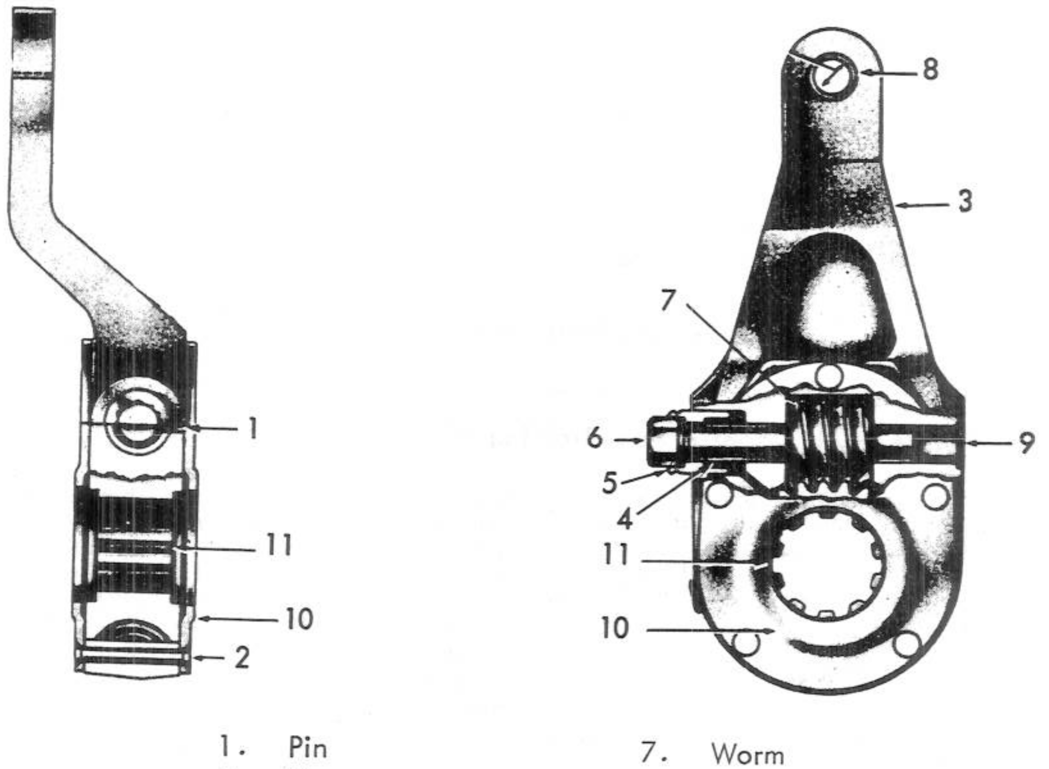
Slack adjusters provide a quick, easy method of adjusting brakes to compensate for brake lining wear. The slack adjusters utilize the worm and gear principle. The main detail parts are; body, worm shaft, worm gear, gear, cover plates, and a locking device.

In normal braking, the entire slack adjuster remains rigid as a unit and rotates with the brake cam shaft as the brakes are applied or released. When brakes are applied (a) air pressure actuates the brake chamber (b) the brake chamber push rod rotates the slack adjuster (c) the slack adjuster rotates the cam shaft and cam, thereby spreading the brake shoes, applying the brakes. When brakes are released, (d) the air pressure in the brake chamber is released, (e) the brake chamber release springs and brake shoe return springs return the brake cam, cam shaft, slack adjuster and brake chamber push rod to the released position.

ADJUSTMENT

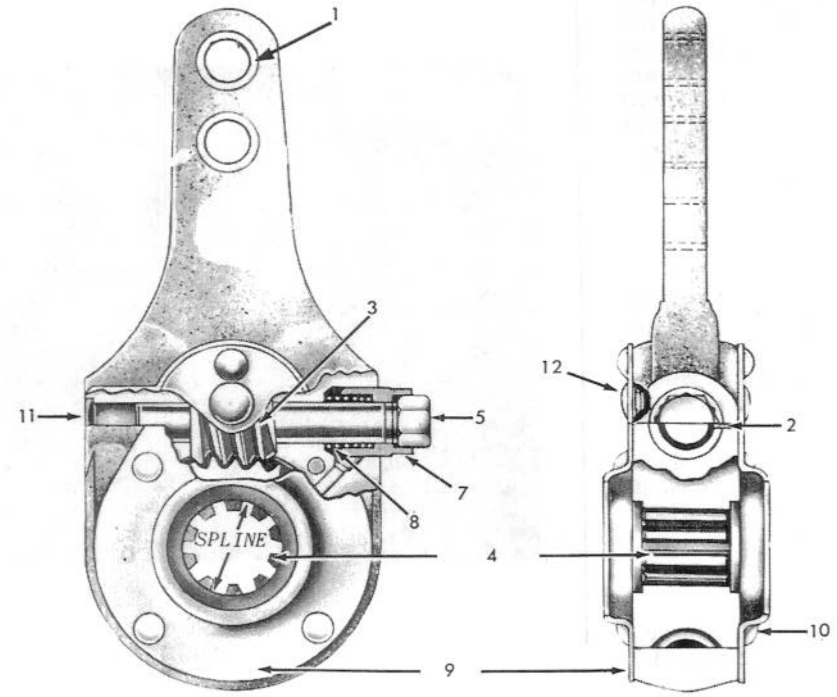
CAUTION: Before adjusting rear brakes ensure that air system pressure is over 60 p.s.i.

Slack adjusters are adjusted by turning the adjusting screw nut on the end of the worm shaft with a common open end, box or socket wrench. Turning the adjusting screw rotates the worm shaft. The worm shaft rotates the worm gear. The worm gear meshes with the slack adjuster gear and the worm gear rotates the slack adjuster gear. The slack adjuster gear is connected to the brake cam by a splined cam shaft. The turning of the slack adjuster gear rotates the cam shaft and brake cam. The



1. Pin
2. Rivet
3. Body
4. Spring - Worm Lock
5. Lock - Worm Shaft
6. Shaft - Worm
7. Worm
8. Bushing
9. Welch Plug
10. Cover
11. Gear - Worm

Figure 4-22: Front & Rear Slack Adjusters



1.	Bushing
2.	Pin
3.	Worm
4.	Worm Gear
5.	Worm Shaft
7.	Lock
8.	Spring
9.	Cover
10.	Rivet
11.	Welch Plug
12.	Button

Figure 4-23: Trailing Wheel Slack Adjusters

brake cam spreads the brake shoes and compensates for lining wear.

Brakes on the vehicle can be adjusted by turning the adjusting screws until the brake shoes are tight against the brake drum with the brake chamber push rod in the released position. Back the adjuster screw off two notches for fronts and three notches for rears.

It is advisable to jack up the wheel when making brake adjustments.

Position the wrench over the adjusting screw and disengage the locking sleeve by depressing it. Make the necessary adjustment by turning the adjusting screw with the locking sleeve in the depressed position.

When the adjustment is completed, be sure the locking sleeve is returned to its locked position by permitting the locking sleeve to engage the hexagon head of the adjusting screw.

After proper adjustment apply the brakes. The slack adjuster arm and brake chamber push rod should form an angle slightly greater than 90 degrees. All slack adjusters on the coach should be at the same angle.

MAINTENANCE

Every 10,000 miles the slack adjuster should be lubricated. Remove grease plug on the slack adjuster and install a grease fitting. Lubricate with a grease gun. It is recommended that the grease used for lubricating slack adjusters meet with the specifications given in Section 10 (Lubrication) of this manual.

OPERATING TEST

Apply brakes and check to be sure slack adjusters rotate freely and without binding. Release brakes and check to be sure slack adjusters return to the released position freely without binding. With brakes released, check to be sure the angle formed by the slack adjuster arm and brake chamber push rod is greater than 90 degrees. With brakes applies, check to be sure the angle formed by the slack adjuster arm and brake chamber push rod is still slightly greater than 90 degrees. All slack adjusters should be set at this same angle.

REMOVAL AND INSTALLATION

To remove a slack adjuster, remove the brake chamber push rod yoke pin. Remove the cap screw and washer at the end of the brake cam shaft which holds the slack adjuster on the brake cam shaft. Other methods of holding the slack adjuster on the brake cam shaft are also used, however, the washer and cap screw method is most common. Slide the slack adjuster off the spline end of the cam shaft.

To install a slack adjuster, provide clearance so the slack adjusters can be rotated to the maximum stroke of the brake chamber or rotochamber. Install grease fitting and locate the slack adjuster on the cam shaft so both the adjusting screw and grease fitting are accessible for servicing. Place the washer and screw or snap ring on the end of the cam shaft to hold the slack adjuster in place. Refer to "Operating Test" above and make sure the proper adjustments are made to provide for these conditions when installing a slack adjuster.

DISASSEMBLY

Remove rivets holding covers and gear in place. Remove welch plug. Press out worm shaft from worm by pressing on the end of the worm shaft opposite the adjusting screw nut. Remove worm shaft, worm shaft lock and worm lock spring. Remove worm and gear from slack adjuster body.

The bushings in the clevis pin holes in the slack adjuster arms may be pressed out and replaced if necessary. Be sure they are reamed to size when pressed in place.

REASSEMBLY

Place worm and gear in slack adjuster body. Position and press the worm shaft, worm shaft lock, and worm lock spring into the worm and slack adjuster body. Be sure to line up the recess in the worm shaft lock with the pin in the slack adjuster body before pressing into position. Install covers and rivets and rivet securely.

AUTOMATIC SLACK ADJUSTERS (OPTIONAL EQUIPMENT)

DESCRIPTION

Automatic slack adjusters are supplied on some coaches as optional equipment at the front wheels, the driving wheels and the rear trailing wheels to compensate for brake lining wear without need for service attention.

Automatic slack adjusters **are not to be adjusted manually** since they are self-adjusting to compensate for brake lining and drum wear, and normally require no service attention except periodic lubrication.

If automatic slack adjusters are found to be out of adjustment due to attempts to adjust them manually, remove the shoulder bolt from adjusting link as shown in illustrations and back out screw "C" two full turns. Re-install shoulder bolt in adjusting link and with proper air supply in brake system make approximately 20 brake applications. This will automatically adjust slack adjusters to necessary requirements.

The slack adjusters should have 3/4" to 1-1/4" throw at the front and rear trailing axles and 1-1/4" to 1-1/2" throw at the rear.

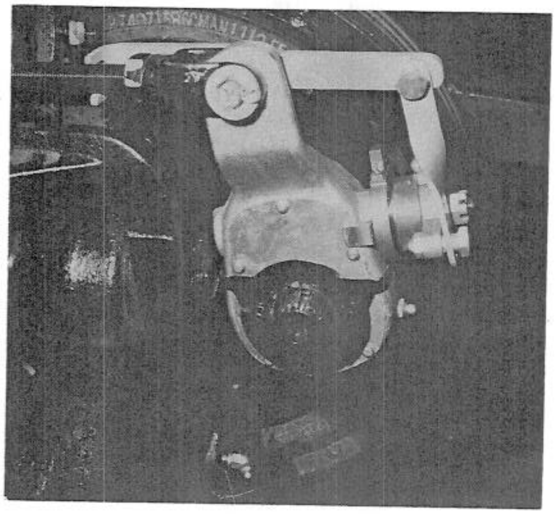


Figure 4-24: Front L.H. Automatic Slack Adjuster Installed

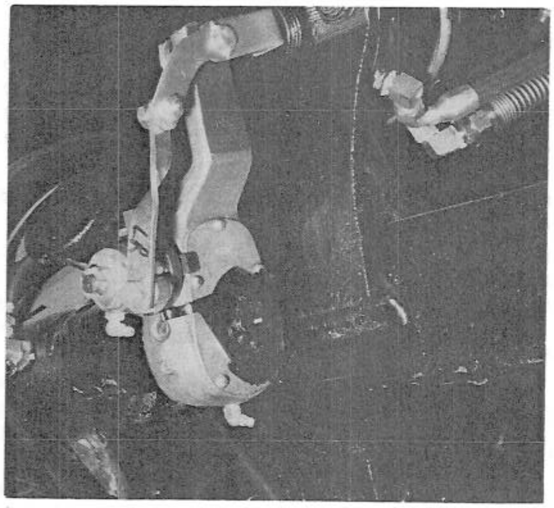
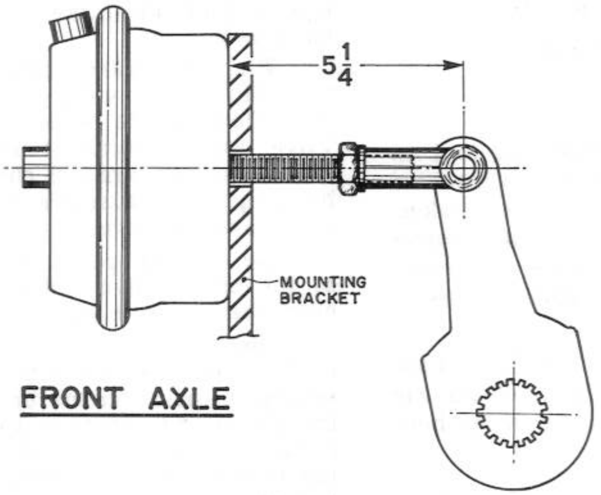
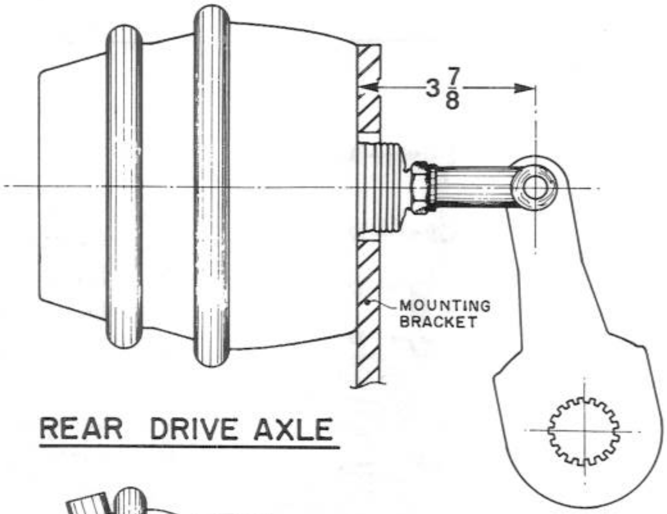


Figure 4-25: Rear L.H. Automatic Slack Adjuster Installed


$5\frac{1}{4}$
MOUNTING BRACKET

FRONT AXLE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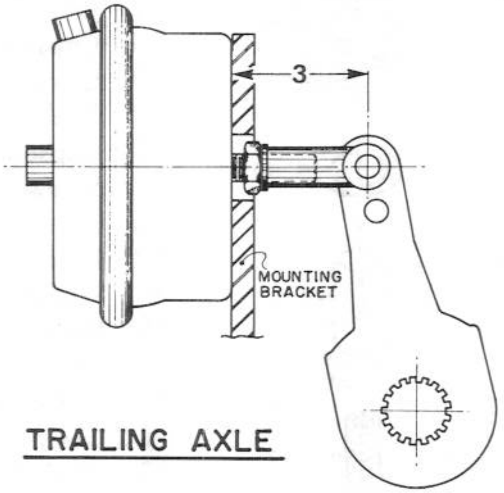
MOUNTING BRACKET

REAR DRIVE AXLE


3
MOUNTING BRACKET

TRAILING AXLE

SLACK ADJUSTER INSTALLATION PUSH - ROD ADJUSTMENT
(AUTOMATIC & STANDARD)

PRESSURE LIMITING VALVE (TRAILING WHEEL BRAKES)

DESCRIPTION

On coaches from Unit No. 10420 thru to Unit No. 11885, a pressure limiting valve was installed in the supply line for the trailing wheel brakes. Effective Unit No. 11886 the pressure limiting valve was discontinued. The pressure limiting valve limits the air pressure to the trailing wheel brakes to 30-35 P.S.I.

The controlling mechanism of the valve consists of a spring loaded piston which closes the inlet valve when the pre-set pressure is reached.

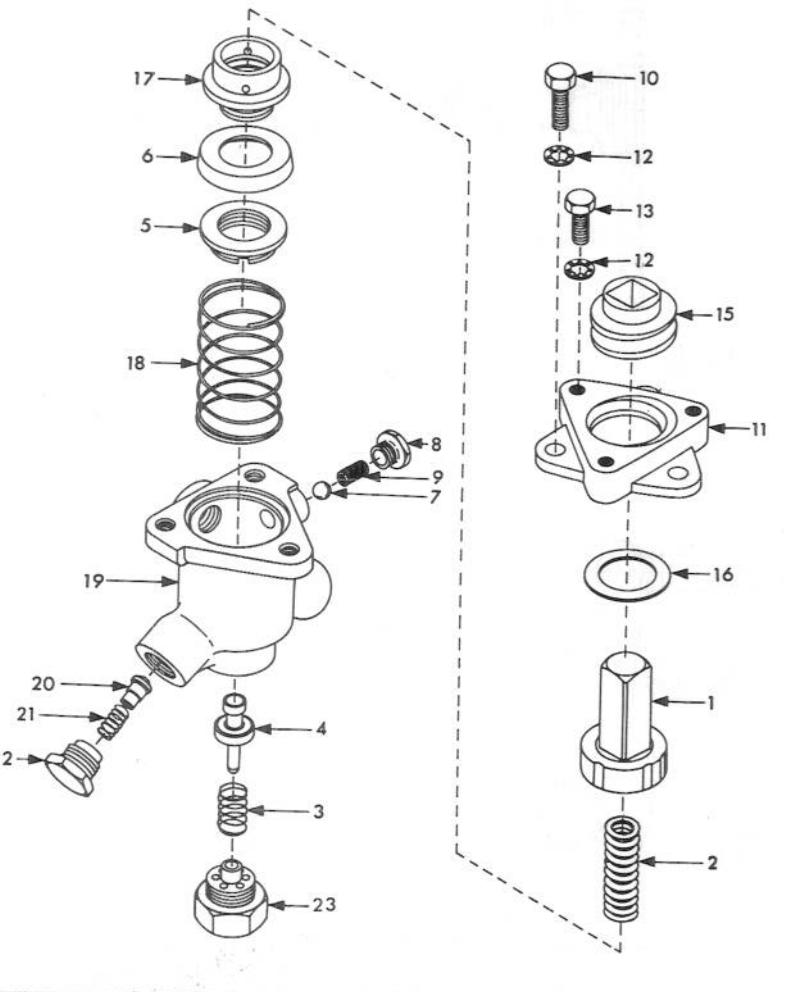
OPERATION

During normal operation, the pressure setting is 30-35 p.s.i. and locked in place by a locking plate and screw.

When the brake valve is applied, air pressure from the brake valve will enter the inlet valve port, flow by the open inlet valve of the limiting valve and out brake chamber port to the brake chambers. The exhaust check valve is held closed by its spring because the same air pressure is above and below the valve.

The delivery pressure position is held as long as the brake valve delivery pressure does not exceed the pressure setting of the limiting valve.

When the delivery pressure from the brake valve exceeds the pressure setting of the limiting valve setting, pressure in the brake chambers and below the piston will overcome the force of the pressure regulating spring above the piston, the piston lifts, the inlet valve closes. With the inlet valve closed, higher pressure cannot pass through the valve



1. Stem
2. Graduating Spring
3. Inlet Valve Spring
4. Inlet Exhaust Valve Assy.
5. Piston Nut
6. Piston Cup
7. Lock Ball
8. Lock Spring Plug
9. Lock Spring
10. Capscrew
11. Cover
12. Lockwasher
13. Capscrew
15. Screw
16. Shim
17. Piston
18. Piston Return Spring
19. Body Assy.
20. Check Valve
21. Check Spring
22. Check Nut
23. Inlet Valve Cap Nut

Figure 4 - 26: Trailing Wheel Brakes
Pressure Limiting Valve

which limits the air pressure being delivered to the brake chambers to the set pressure.

The exhaust valve remains closed because the pressure regulating spring force on the piston balances the force exerted by air pressure below the piston with the exhaust valve seated.

The exhaust check valve remains closed because the force exerted by its spring and brake valve air pressure below the check valve is greater than air pressure force above the check valve.

NORMAL RELEASE POSITION: The limiting valve remains in "Limiting Position" until brake valve pressure is reduced below the limiting valve pressure setting. As the brake valve pressure drops, the exhaust check valve opens, brake chamber pressure by-passes the closed inlet valve, escapes through the brake valve.

The exhaust check valve opens before the inlet valve because the exhaust check valve spring is not as strong as inlet valve spring and is more sensitive to air pressure differential.

As air pressure below the limiting valve pressure setting is reduced, pressure regulating spring force on the piston overcomes the force of air pressure below the piston which moves the piston down and opens the inlet valve. Brake chamber pressure releases through both inlet valve and exhaust check valve until the release is complete and exhaust check valve again seats.

MAINTENANCE

1. Every year or after each 50,000 miles: Disassemble the regulating valve and clean all parts. Install new inlet and exhaust valve assembly, new exhaust check valves, and new piston packing cup.
   NOTE: Lock valve to 30-35 p.s.i. setting.

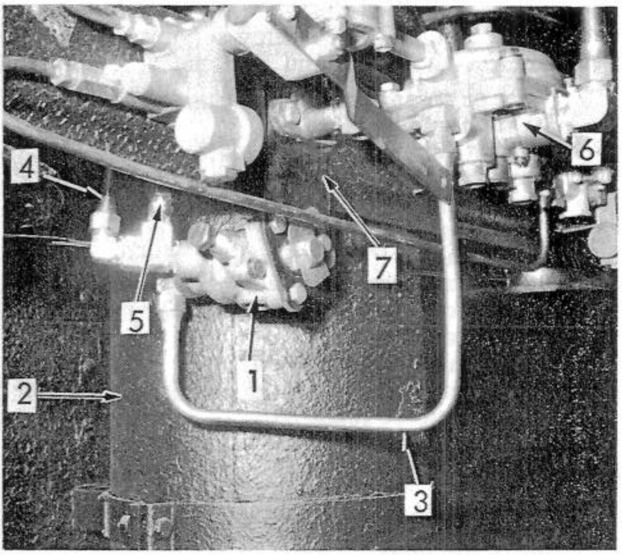
TESTING FOR SERVICEABILITY

(1) OPERATING TEST: Connect a test gauge to one of the trailing wheel brake chamber lines and fully apply the brake valve with the limiting valve in its adjusted position. A tolerance of plus or minus six pounds of air pressure is permissible at each setting.

(2) LEAKAGE TEST: Set the valve to a position which will permit fifty-five pounds of pressure delivered. Fully apply the brake valve. Coat the exhaust port of the valve with soap suds. If leakage occurs, it is caused by dirty or worn valve or valve seats or by a worn piston packing cup. Leakage of a three-inch soap bubble in three seconds is permissible.

REMOVAL

1. Disconnect air lines to valve and remove valve capscrews.
2. Remove valve from between rear wheelhousings.



1. Limiting Valve
2. Wet Tank
3. Air Line - Relay Valve to limiting valve
4. Air Line - Limiting valve to trailing brake line L.H.
5. Air Line - Limiting valve to trailing brake line R.H.
6. Relay Valve
7. Limiting Valve Mtg. Bracket

-Figure 4-27: Trailing Wheel Brakes Pressure Limiting Valve Installed

INSTALLATION

1. Mount the valve and bracket to cross-member between rear wheelhousings.
2. Clean and connect air lines.

DISASSEMBLY

1. Loosen capscrew and stem lock.
2. Remove the spring plug cap nut holding the lock ball in place at the side of the body.
3. Remove six capscrews holding the cover to the body.
4. Remove the stem and screw from the cover
5. Remove pressure regulating spring, piston and piston spring from the body.
6. Remove inlet valve cup nut.
7. Remove inlet valve spring and inlet and exhaust valve assembly from the body.
8. Remove exhaust check valve cap nut.
9. Remove exhaust check valve spring and check valve. •

CLEANING AND INSPECTION

1. Wash all metal in cleaning solvent.
2. Inspect the inlet and exhaust assembly for wear or damage. If worn or damaged excessively, it should be replaced.
3. Inspect exhaust check valve for wear or damage. It should be replaced if worn or damaged.
4. Inspect piston packing cup for signs of wear or damage. If damaged or worn, replace.
5. Inspect all metal parts, such as cones, body, stem, etc., for cracks or damage. Replace, if cracked or damaged.
6. Check the five springs used in the valve for cracks or damage. If damaged or cracked, they should be replaced.

ASSEMBLY

1. Assemble exhaust check valve spring and cap nut to the body.
2. Assemble inlet and exhaust valve assembly, inlet valve spring, and inlet valve cap nut to the body.
3. Install the piston spring and piston in the body.
4. Position the screw and stem in the cover.
5. Place the pressure regulating spring on the piston in the body.
6. Position the cover to the body and attach with six capscrews.
7. Assemble the lock ball, lock spring, and lock plug to the body.
8. Position lock on stem and tighten capscrew at the lock.

TEST OF REBUILT VALVE

Both operating and leakage tests, as indicated under section headed "Testing for Serviceability" must be performed after rebuilding or repairing a valve.

PRESSURE REGULATING VALVES

DESCRIPTION

A pressure regulating valve controls the pressure of compressed air. It remains opened until its setting is reached; it closes when the desired air pressure setting has reached its pressure.

LOCATIONS USED:

1. Lavatory Door Control
2. Alternator Belt Tension
3. Blower Belt Tension
4. Trailing Wheel Bellows
5. A/C Compressor Belt Tension
6. Parking Brake
7. Windshield Wipers (Prior to Unit #10827)

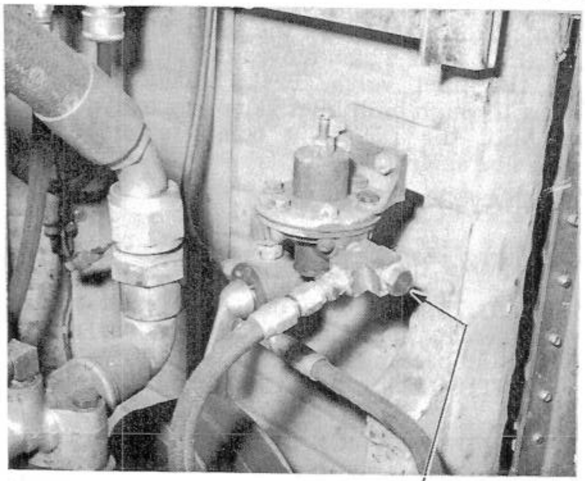
NOTE: Refer to specifications at end of section for Part No., Model No. and pressure settings.

ADJUSTMENT

The pressure setting is determined by the tension of the spring which in turn is controlled by an adjusting screw at the top of the valve. Turning the adjusting screw clockwise raises the pressure setting; counter-clockwise reduces the setting. The lock-nut must be tightened after final adjustment is accomplished.

MAINTENANCE

Every 50,000 miles or yearly. Check the mount- the bolts and pressure adjusting screw are secure and that there is no air leakage.



Install a test gauge at this point for adjusting or checking regulator valves

TESTING

A tee fitting and plug are installed in the outlet port of the pressure regulating valves. This will enable to install a test gauge at these points for adjusting or checking the pressure regulating valves settings.

NOTE: Pressure regulating valves that can be checked by a test gauge are:

(A) Alternator Belt Tightener
(B) Cooling Blower Belt Tightener
(C) A/C Compressor Belt Tightener
(D) Trailing Axle Bellow Supply

CLEANING AND INSPECTION

Wash all metal parts in cleaning solvent. If diaphragm is cracked, worn, or damaged, replace. Replace any other parts excessively grooved or pitted. Screen at inlet port should also be removed and/or cleaned.

BRAKES

DESCRIPTION

The brakes used on the coach are heavy duty, two shoe type. Shoes are mounted with individual anchor pins on open-type spiders. The brakes are actuated by "S" type, constant lift cams which are forged integral with the shaft and mounted in needle bearings. Cam pressure is applied through roller cam followers attached to the brake shoes.

DRUMS

Re-boring of brake drums is not recommended due to the reduced strength of refaced drums. As an economy measure, in order to salvage drums, some operators do follow this practice.

When refaced drums and oversize linings are used, precautions regarding cam travel should be observed to prevent sticking cams or cam "roll over". This

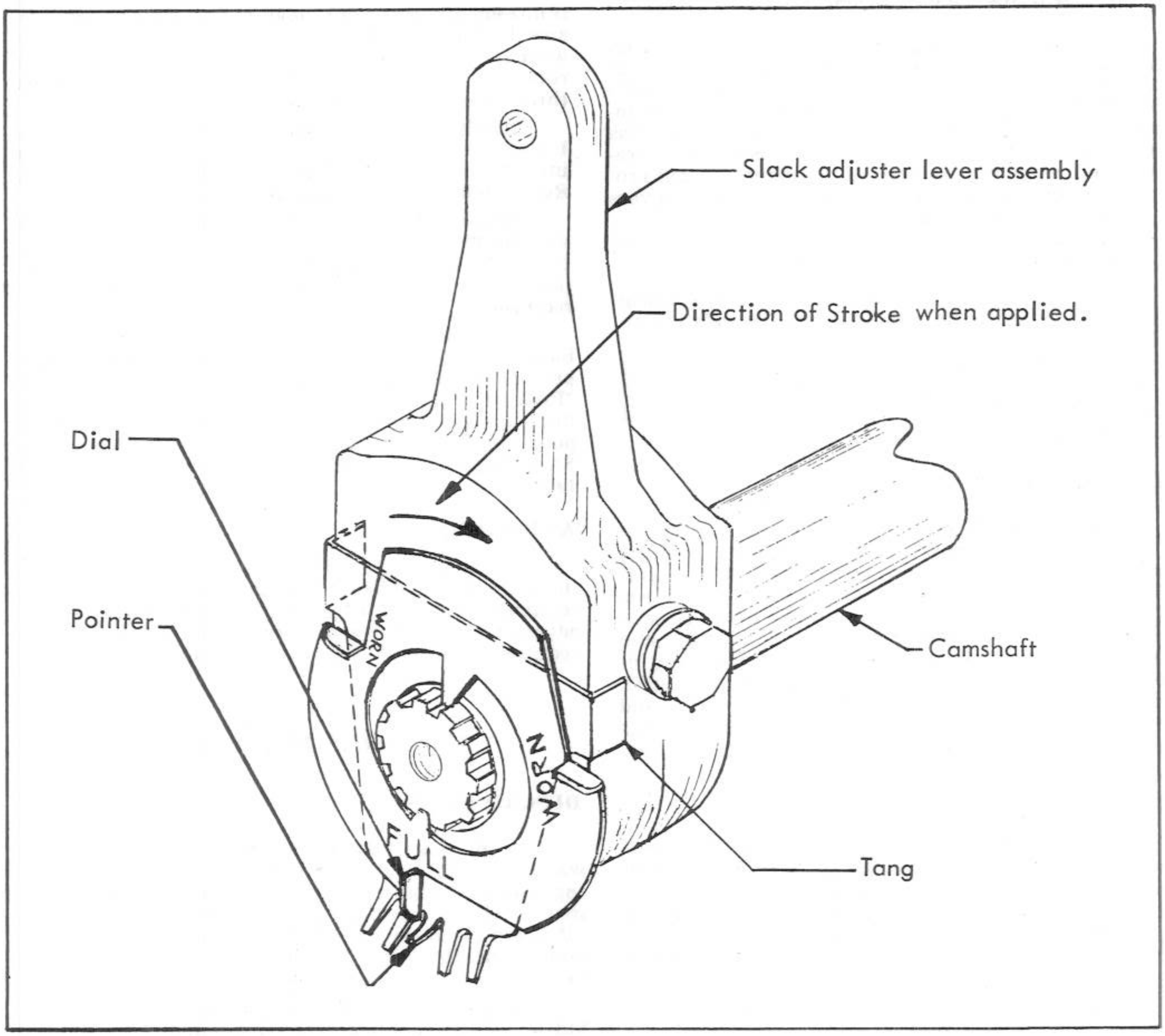

Slack adjuster lever assembly
Direction of Stroke when applied.
Dial
Pointer
Camshaft
Tang
WORN
WORN
FULL

Figure 4 - 28: Brake Lining Wear Gauge

condition may occur when linings become worn. The service instructions relative to the use of oversize roller cam followers should be carefully followed. Drums which have been refaced should be installed on vehicles operating under the least severe conditions.

BRAKE LININGS

Linings vary considerably in size and content. They should be replaced only with linings which conform with the manufacturer's recommendations.

BRAKE MAINTENANCE

A schedule for the periodic adjustment, cleaning, inspection and lubrication of brake equipment should be established by the operator on the basis of parts particularly subject to wear depreciation. To compensate for this wear, brakes should be adjusted as frequently as required to maintain satisfactory operation and maximum safety. Adjustments should provide uniform lining clearance, correct travel of levers and proper equalization.

Brakes should be cleaned, inspected, lubricated and adjusted each time the hubs are removed.

Brake lining wear may be determined by reading gauge showing brake cam position in relation to slack adjuster. When adjustment is made to brakes, pointer will move toward part of dial marked "Worn." Reading gauge when brakes are adjusted will show just how far pointer has been moved and thus how much the linings are worn.

DISASSEMBLY

Remove wheels as outlined in Section 15 (Wheels, Hubs & Tires). Remove shoe return spring. Remove lock rings, retainers and felts from anchor pins. Cut lock wire and remove anchor pin lock screws. Remove anchor pins and shoe assemblies. Loosen Allen screws and remove roller cam followers and pins. Remove slack adjuster. Remove lock ring or loosen lock screw in spacer and remove cam shaft. Wire spacers to brake spider. Remove washers and felts from cam shaft and spider. Remove bushings from shoe of bearings from spider as required.

REPAIR

During major overhaul, the following parts should be carefully checked and if necessary, replaced with genuine replacement parts as required: Backing plates for distortion, and backing plates and spiders for looseness or sheared rivets; Anchor pins for wear or misalignment; Brake shoes for wear at anchor pin holes, wear plates or angle faces; Cam shafts and cam shaft bearing or bushings for wear or brinelling; Shoe return springs should be replaced at the time of overhaul; Brake linings for grease saturation, wear, and loose rivets or bolts; Drums for cracks, scoring or other damage.

Prior to reassembling, the following parts should be LIGHTLY COATED with lubricant. Anchor pins at abutment block or shoe surface; Adjustable anchor pin bearing surface; Cam shaft bearings or bushings; Cam roller followers or wear plates.

REASSEMBLY

Install new bushings in brake shoes if required New bushings must be line reamed to size before assembling shoes. Install new bearings in brake spider as required.

Install roller cam followers and pins. Tighten Allen lock screws securely.

CAUTION: See instructions relative to roller cam followers where drums have been refaced and oversize liners installed. Install large washers, felt and washer on cam end of shaft. Install washers, felt retainers and spacers when inserting cam shaft through spider and bracket.

Install lock ring or tighten set screw in spacer. Position brake shoe over spider and tap anchor pin into position with "flat" in line with lock screw hole. Repeat with opposite shoe assembly.

Install lock screws, tighten securely and thread with lockwire. Position felts, retainers and install lock rings. Install shoe return spring. Install slack adjuster on splined end of cam shaft and adjust as required.

Assemble pointer to slack adjuster with tangs locking in place. Assemble dial to camshaft in approximate position as shown with slack adjuster in "Full Off" position. Turn word "Full" on Dial to line up with one of the pointers. Cut off excess pointers that Dial does not line up with. Assemble Snap rings using washers to take up end play if necessary.

ADJUSTMENT

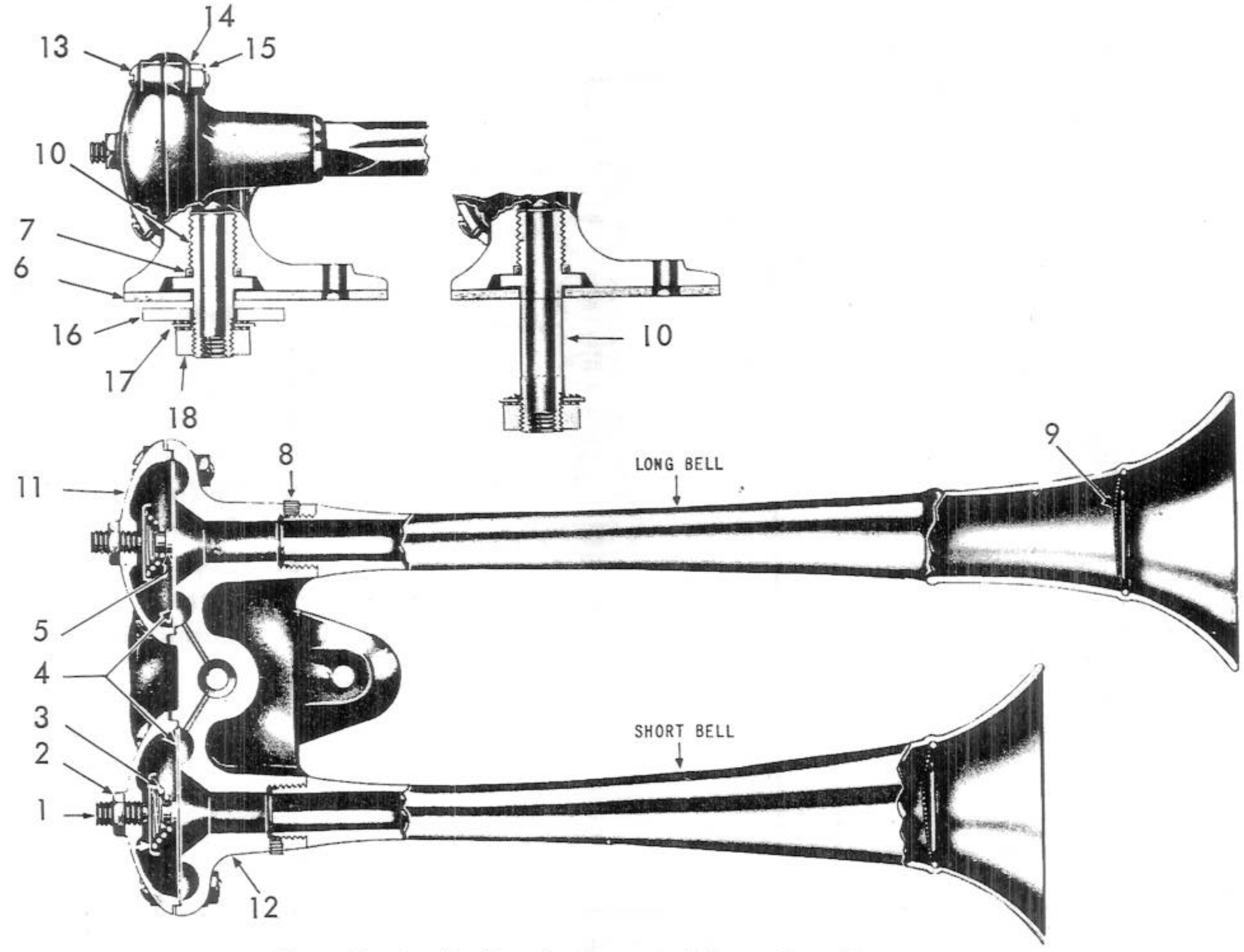
New linings should be circle ground to a few thousandths less than drum diameter. Adjust cam as required to obtain 80 percent contact. Adjust slack adjuster on splined end of cam shaft and adjust as required. See "Slack Adjusters" in this section.

AIR HORNS AND VALVE

DESCRIPTION

The purpose of the air horn is to provide a warning signal of greater volume and farther carrying qualities than usually found on automotive vehicles. The horn is designed on the principle of a vibrating diaphragm. The horn consists of die cast bodies, diaphragms, and two chrome plated horn bells, with the bells in a horizontal position.

The horn is operated by pushing down on the button of the foot-operated horn valve. This action pushes down on the supply valve stem in the horn valve and opens the supply valve.



1. Seat - Spring Assy.
2. Lock Nut
3. Spring
4. Diaphragm
5. Contact Spring
6. Gasket
7. Grommet
8. Set Screw
9. Screen
10. Coupling
11. Cover
12. Body
13. Screw
14. Washer
15. Nut
16. Washer
17. Washer
18. Nut

Figure 4-29: Air Horns

When air enters the cavity in the air horn on one side of the diaphragm, pressure builds up on the diaphragm and deflects it and the air escapes through the horn bells. This action sets up a vibration of the diaphragm in each horn bell. The two different lengths of horn bells give the horn its dual tone. The vibrations are set up in an air column denser than atmosphere, due to escaping compressed air, which provides unusual tone carrying qualities.

MAINTENANCE

Every 10,000 miles, remove strainer in bottom of horn valve and clean thoroughly with cleaning solvent. Remove dirt screens in the horn bells and clean.

Every 50,000 miles, disassemble the air horn and clean all parts. Disassemble the air horn valve and clean all parts.

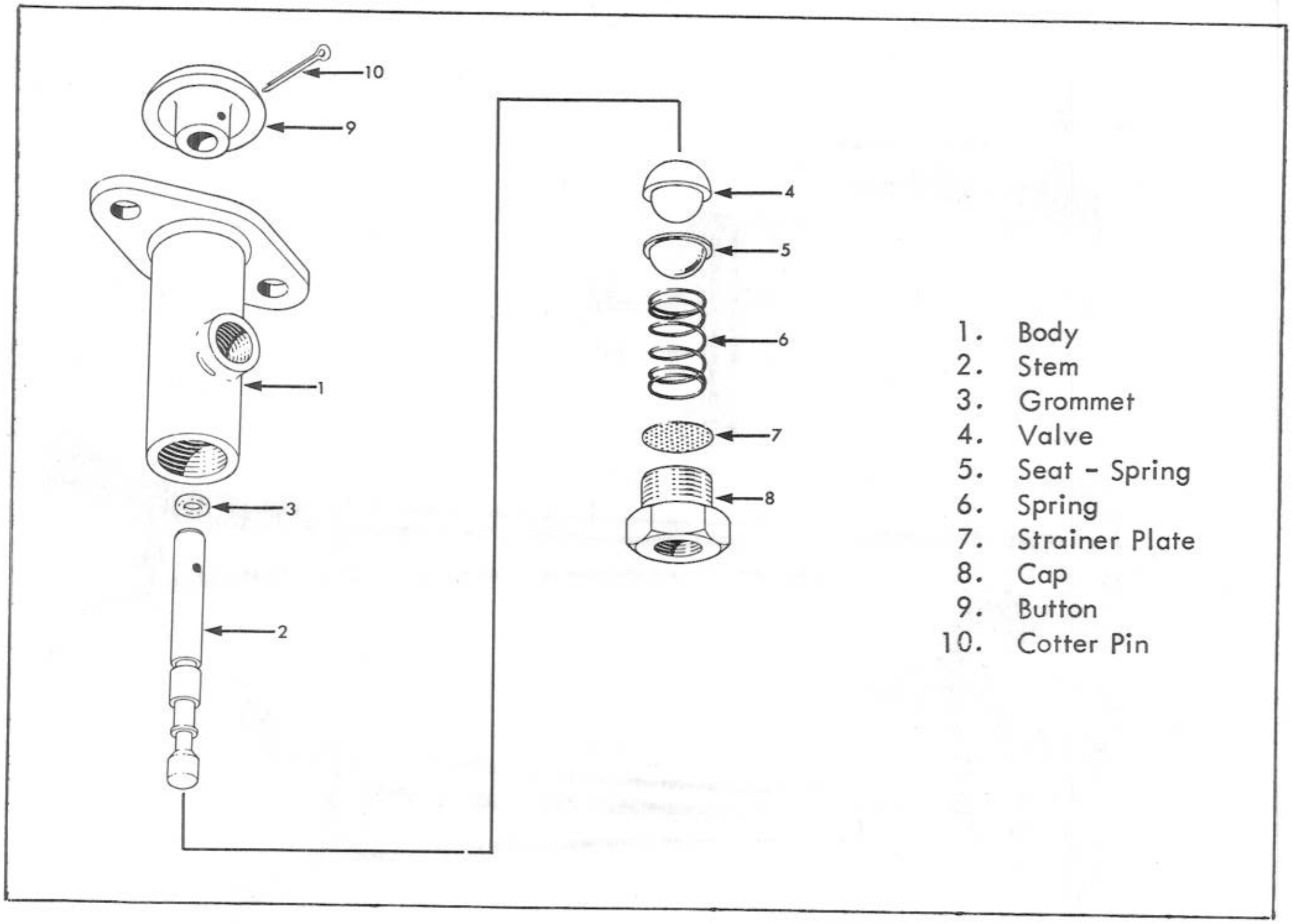


Figure 4-30: Air Horn Valve

With air pressure in the system, operate the horn valve and the horn should give a loud, clear dual tone horn blast.

With horn valve in the released position, leakage at the delivery port or at the valve stem at the top of the horn valve should not exceed a one-inch soap bubble in one second. With the horn valve applied, leakage at the stem at the top of the horn valve should not exceed a one-inch soap bubble in one second.

DISASSEMBLY AND REPAIR

Remove the eight nuts and bolts holding the two covers to the body. Remove the diaphragms from the body of the air horn. Remove the spring contact, springs, and spring assemblies from the covers of air horn. Remove the horn bells from the body.

CLEANING AND INSPECTION

Wash all metal parts in cleaning solvent. Carefully inspect the diaphragms to be sure they are not cracked, deteriorated, or distorted in any way. If ridges or cracks are found, the diaphragms must be replaced. Inspect condition of the body. Be sure diaphragm seat in body is not chipped or damaged in any way. Check for cracks in the body. If these conditions prevail, replace covers. Inspect the horn bells. If they are cracked or broken, they should be replaced. Inspect the spring contacts. If distorted or deteriorated, they should be replaced. Check the spring. If broken, replace.

REASSEMBLY

Place the diaphragms in the body. Install the spring contacts, springs, and spring assemblies to the covers. Install the eight bolts and nuts, attaching cover to the body. Care should be used to be sure equal pressure is exerted on all screws holding the cover to the body. Assemble the horn bells to the body.

TEST OF REBUILT AIR HORN

Both operating test and leakage test must be made after rebuilding or repairing an air horn. If air horn does not operate satisfactorily, adjustment of the spring load behind the diaphragm can be made by turning the adjusting screw in the cover. Before attempting to turn the adjusting screw loosen the adjusting screw lock nut. Be sure to tighten the adjusting screw lock nut after any adjustment.

ALCOHOL EVAPORATOR (OPTIONAL)

DESCRIPTION

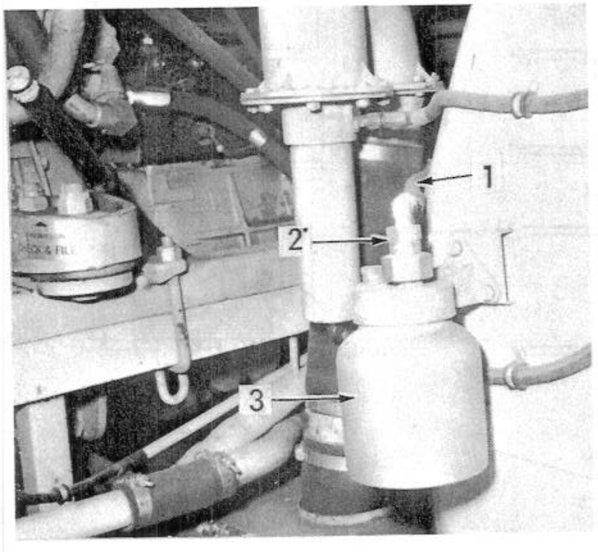
The purpose of the alcohol evaporator is to permit vaporized alcohol to be drawn into the air brake system and thus guard against freezing of moisture in the brake system during cold weather operation.

The device consists of a casting forming a support for a reservoir for ordinary methyl alcohol, which in a vaporized state, is drawn into the system.

OPERATION

While the Compressor is compressing air, a partial vacuum is present in the Compressor Intake Manifold.

The alcohol evaporator is connected to the compressor intake manifold, therefore a partial vacuum is also created above the alcohol in the jar.



1. Line - Air Compressor to Alcohol Evaporator
2. Check Valve
3. Alcohol Evaporator Jar

Figure 4-31: Alcohol Evaporator

Atmosphere then passes through the Air Strainer, through the cored passage in the cover, down the tube leading to the bottom of the jar, and then bubbles up through the alcohol and out through the tubing line to the compressor intake manifold. The passing of the air bubbles through the alcohol causes some of the alcohol in the form of vapor to be carried along with the air stream through the Compressor and into the air system. The alcohol thus introduced into the air system acts as an antifreeze.

MAINTENANCE

1. Every three months or after each 10,000 miles remove the strainer in the bottom of the body near the mounting flange and clean thoroughly using cleaning solvent.
2. Every year or after each 50,000 miles disassemble the alcohol evaporator and clean all parts. Replace all gaskets.

REMOVAL

1. Disconnect the line from the alcohol evaporator to the air compressor.
2. Remove mounting bolts and remove alcohol evaporator.

CLEANING AND INSPECTION

Wash all metal parts in cleaning solvent. Carefully inspect the jar gasket. Be sure it is not cracked, deteriorated or distorted in any way. If damaged, it should be replaced. Inspect the condition of the evaporator tube. Be sure it is not plugged or restricted with foreign matter. Inspect the body to be sure it is not broken or cracked. It should be replaced if these conditions prevail. Inspect the jar to be sure it is not cracked, replace if cracked.

ASSEMBLY

(1) Replace tube and fittings into body.
(2) Install filler plug to body.
(3) Install check valve to body.
(4) Install gasket on to body.
(5) Screw the body onto the jar. Make sure the body is secured on tight.

INSTALLATION

(1) Securely bolt the alcohol evaporator to the bracket mounted on the wheelhousing.

(2) Connect line from air compressor to alcohol evaporator.

(3) After connecting, fill jar about two-thirds full of commercially pure methyl 188 proof alcohol. The alcohol should be free of any inhibitor.

TEST

When the compressor is compressing air, air bubbles should be passing through the alcohol. If air bubbles are not present when the compressor is compressing air, then the Alcohol Evaporator is not functioning properly. Check to be sure all connections are tight. Check condition of Filler Cap Gasket and Cover Gasket.

TEST OF REBUILT ALCOHOL EVAPORATOR

The operating test, shown under Section "Testing For Serviceability," must be performed after rebuilding or repairing the alcohol evaporator.

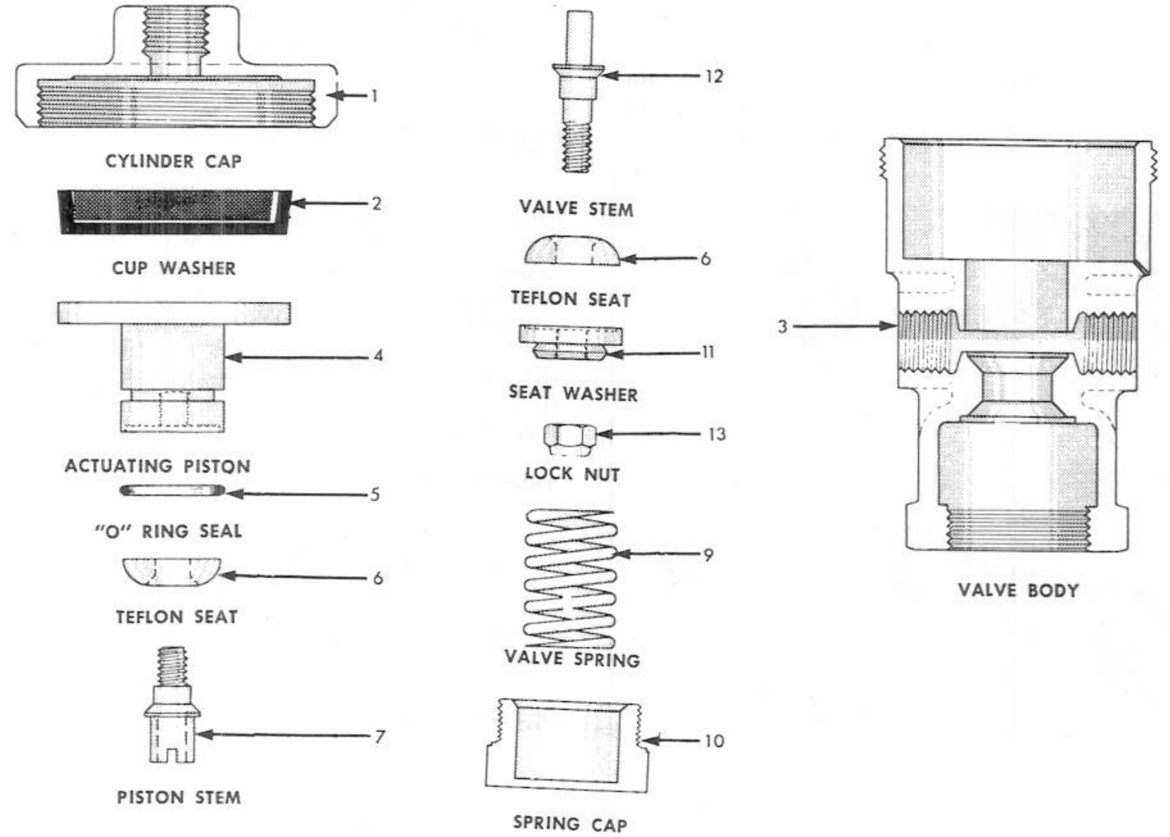
AUTOMATIC AIR TANK DRAIN (GRAHAM WHITE) (OPTIONAL)

DESCRIPTION

The moisture ejector valve air tank drain is actuated each time a service brake application is made. The service brakes when applied actuate the air switch which in turn energizes the solenoid valve, thus allowing air to the ejector valve which ejects moisture from the air tanks.

OPERATION

A positive and dependable automatic drain is being used as optional equipment to remove water, oil, scale and sludge automatically as they accumulate. This is to prevent costly brake failures, damaged diaphragms or frozen and broken air lines. The automatic drain valve meets all requirements for - positive draining and dependable trouble-free operation. All seats holding reservoir pressure are made of Teflon - the material proved to be the best for this service - not affected by oil, sludge, acid or scale. Seats and seals are easily replaced - no machine work necessary.



1. Cylinder End Cap
2. Cup Washer
3. Valve Body
4. Piston
5. "O" Ring Seal
6. Piston Seat
7. Piston Stem
9. Valve Spring
10. Spring Cap
11. Seat Washer
12. Valve Stem
13. Lock Nut

Figure 4-32: Moisture Ejector Valve (Graham White)

(DISASSEMBLY)

Unscrew spring cap (10) and remove from the valve body (3). Remove valve spring (9) and intake valve assembly, consisting of seat (6), seat washer (11), and valve stem (12) as an assembly from valve body. Turn seat washer (11) off valve stem (12). Remove seat (6) from valve stem (12). At opposite end of ejector valve assembly, unscrew cylinder cap (1) and remove from valve body (3). Push on piston stem (7) and remove cup (2), piston (4), o-ring (5), seat (6), and piston stem (7) from the valve body (3). Unscrew piston stem (7) from piston (4). Remove seat (6). Remove o-ring (5) from piston and discard.

INSPECTION

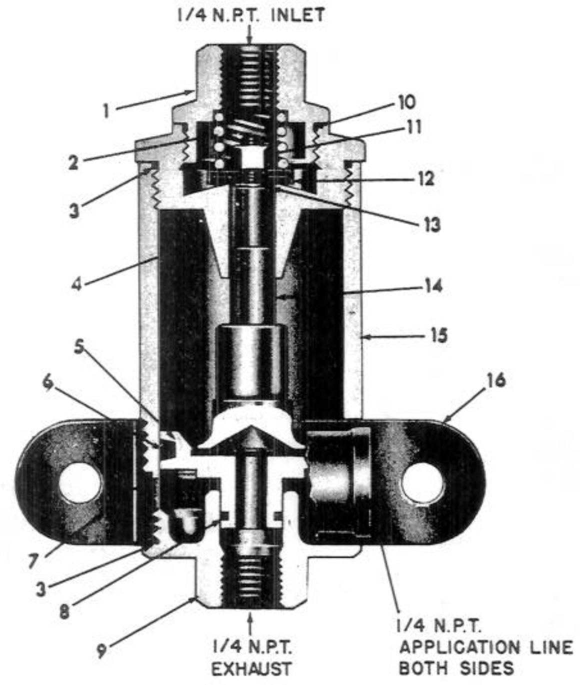
Clean all parts thoroughly with cleaning solvent. Wipe or blow parts dry. Examine cylinder cap, valve body and spring cap for cracks, stripped threads, or other damage. Inspect valve cup, piston, seat washer, and seats for wear or damage. Check valve stem and piston stem for distortion, stripped threads, or other damage. Inspect valve spring for free length, compressed length, distortion, or collapsed coils. (Refer to "Mainenance" later for measuring free height of spring).

ASSEMBLY

Install a new o-ring (5) in groove of piston (4). Position seat (6) to piston (4); then thread piston stem (7) into piston (4). Insert piston assembly into the valve body (3). Install cup (2) into body (3); then thread cylinder cup (1) on valve body. Tighten firmly. Position seat (6) on the valve stem (12); then thread seat washer (11) on stem. Install intake valve assembly, consisting of parts assembled above in the valve body (3). Position valve spring (9) against seat washer (11) in the valve body. Thread spring cap (10) into the valve body (3). Tighten cap firmly.

MAINTENANCE

Before assembly of valve spring, measure free height of spring (9), if less than 1-7/16", it should be replaced.



1. Upper Cap
2. Spring
3. Gasket
4. Guide Post
5. Actuator
6. "O" Ring
7. Gasket
8. "O" Ring
9. Lower Body
10. Gasket
11. Lock Nut
12. Inlet Seal
13. Gasket
14. Plunger
15. Column
16. Body

Figure 4-33: Moisture Ejector Valve (Sealco)

LUBRICATION

Cup washer (2), O-ring (5) and piston groove (4) should be lubricated at regular intervals with silicone grease. Recommended G.W. 2750 grease.

MOISTURE EJECTOR VALVE (SEALCO)

DESCRIPTION

An automatic drain valve (Sealco) may be installed on to the wet air tank to remove sludge and moisture from the air system. The automatic drain valve (Sealco) is actuated whenever the service brakes are applied.

DISASSEMBLY

Disassemble the automatic drain valve (Sealco) by following the procedure explained below: Remove the upper cap (1), remove spring (2), lower body (9) and actuator (5). Do not remove column (15). Loosen guide post (4), remove lock nut (11), gasket (3) and inlet seat (12). Remove all O-rings and gaskets. Wash all parts in pelrateum solvent. Inspect for damaged rubber seats, knicks and scored metal surfaces. Replace damaged parts.

ASSEMBLY

Before assembly of automatic drain valve (Sealco), lubricate all "O" ring grooves, gaskets, seats and cylinder bores which contact "O" ring seals with light grease or lube oil. Assemble plunger (14) through guide post (4). Assemble inlet seat (12) rubber side up. Install lock nut (11) and screw onto plunger (14) and tighten to 20-25 inch lbs. torque. Install gasket (10) onto upper cap (1). Lubricate gasket, install spring (2) and screw cap (1) into the guide post (4). Tighten to 20-25 ft. lbs. torque.

TESTING

To test automatic drain valve (Sealco), apply approximately 120 P.S.I. air pressure to inlet port and application port. Immerse the valve into water, if no pressure leaks occur then the valve is acceptable.

FIELD TEST FOR AIR LOSS AND VALVE SERVICEABILITY: It is recommended that the

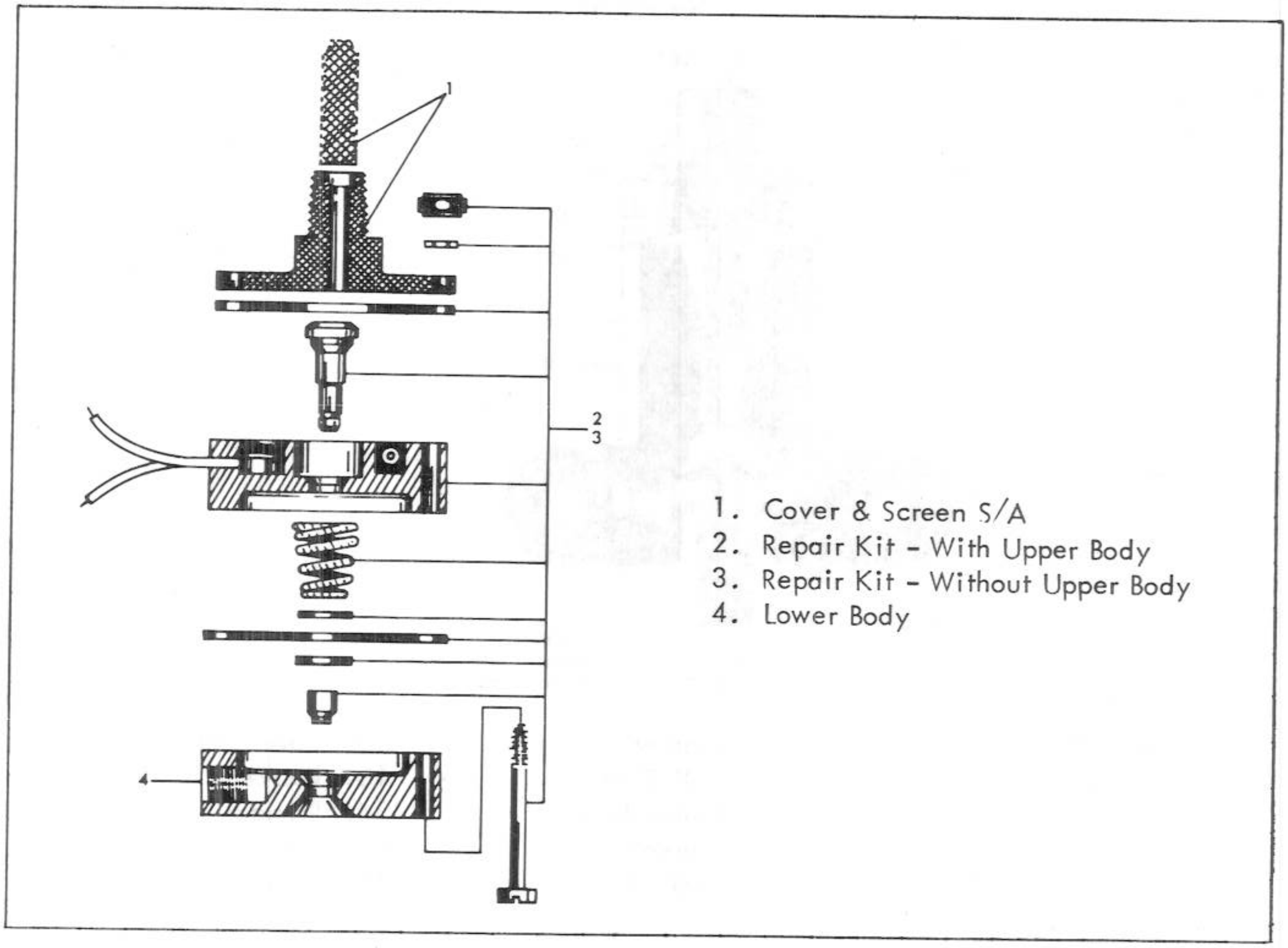

1
2
3
4
1. Cover & Screen S/A
2. Repair Kit - With Upper Body
3. Repair Kit - Without Upper Body
4. Lower Body

Figure 4-34: Moisture Ejector Valve (Expello)

automatic drain valve be serviced if the valve fails to exhaust when the application pressure is released or if the air loss through the valve is in excess of 1 lb. per minute at 100 P.S.I. in either the applied or unapplied position.

MOISTURE EJECTOR VALVE (EXPELLO)

DESCRIPTION

An automatic drain valve (Expello) may be installed on the wet air tank to prevent freezing of air system in cold weather operation. The automatic drain valve (Expello) is actuated by the brake application.

DISASSEMBLY

Disassemble the valve by removing the four screws and cleaning thoroughly. Check the external wire assembly for deterioration and electrical connections. Check body as to condition of seat and for cracks around inner wall. If defective, replace.

Place valve in upright position on solid surface or in vise.

Put valve stem through upper half of valve and place in an inverted position over bottom die making sure the valve end of the stem is centered on die.

Put spring in place with large diameter against upper housing.

Place over the valve stem, one washer then the diaphragm and then another washer and then the machined sleeve. You are now ready to swage the nut into place. However, you must make sure that the spring is not caught between the first washer and the end of the stem. This is very important.

REASSEMBLY

In reassembling the expello valve make sure that the exhaust hole (this is not the center hole) in the lower housing is lined up with the exhaust hole in the upper housing, also that the valve stem is centered with the exhaust port in the center of the lower half of the valve. This can be easily done by shifting the stem to one side or the other just before you tighten up the four bolts on the valve. In other words, leave nuts on three bolts a little loose until after you have checked the stem position in the lower half, then tighten nuts tight so that there are no air leaks.

LEAKAGE TEST

Check the valve for leakage by coating the vent hole with soapsuds while valve is under 80 to 100 P.S.I. air pressure. Check the valve for proper operation.

DISCHARGE AIR FILTER DRYER

DESCRIPTION

A discharge air filter is installed on the rear of the rear bogie in the main air line between the air compressor and the wet air tank. The purpose of the air filter dryer is to remove water and oil vapor from the air system, by means of condensation and a desicant. This provides longer component life and helps prevent freeze-up. The system is self-purging during the unloading cycle of the air compressor.

The housing assembly consists of two cylindrical steel stampings welded together. A safety valve is mounted in the housing assembly protecting against excessive pressure build-up within the housing. The desiccant plate assembly is located mid-way in the housing assembly and houses a replaceable ball-type single check. Also located in the plate assembly is the purge orifice.

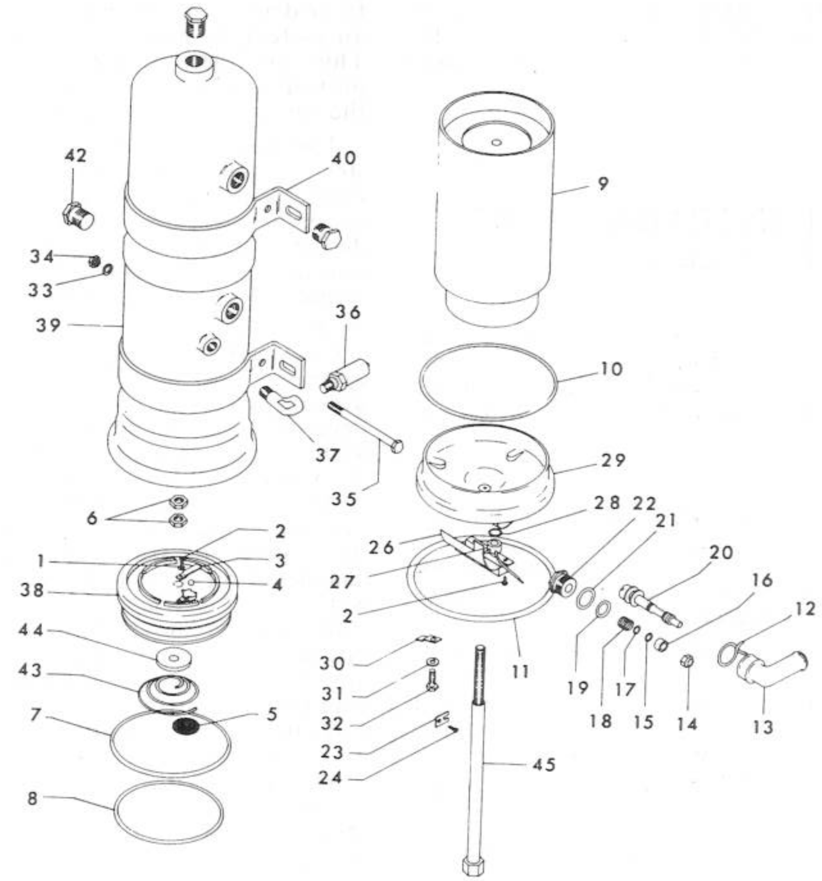
CHARGE CYCLE: Compressor in compressing cycle — With the compressor in its "loaded" or compressing cycle, air from the compressor enters the air dryer through the discharge line. When the air, along with the water and contaminents, enter the air dryer, the velocity or speed of the air reduces substantially and much of the entrained liquid drops to the bottom or sump of the air dryer. The initial air flow is toward the bottom of the dryer, but air flow direction changes at the bottom of the air dryer, dropping some water and oil. The air now passes through the oil filter which removes some oil and foreign material but does not remove water vapor. At this point, the air remains saturated with water. The filtered air and vapors penetrate the desiccant drying bed and the absorption process begins. Water vapor is removed from the air by the desiccant.

PURGE CYCLE: When desired system pressure is reached, the governor cuts out at 115-118 P.S.I. (793-814 kPa), pressurizing the unloader cavity of the compressor which unloads the compressor (non-compressing cycle). The line connected from the compressor unloader port to the end cover purge valve port (bottom of the air dryer) is also pressurized, moving the purge valve plunger, opening the exhaust of the purge valve to atmosphere. With the exhaust of the purge valve open, contaminents in the discharge line and dryer sump are purged, or forced past the open exhaust out to atmosphere. The reverse air flow across the desiccant starts the removal process of moisture from the desiccant surface. Dry air flowing from the purge volume through the purge orifice and across the drying bed further dries the desiccant.

The combination of these reverse flows literally strips the water vapor from the desiccant (drying bed). This normally takes between 12-15 seconds. The desiccant becomes activated from this cycle and is now ready for another charge cycle, which occurs when the compressor returns to the compressing cycle.

MAINTENANCE

Every 25,000 miles (40,000 km) or every three (3) months: Check for moisture in the air brake system by opening drain cocks in the air reservoirs and checking for presence of water. In areas where more than approximately a 30" range of temperature is common, small amounts of water can accumulate in the air brake system reservoirs, lines and components due to condensation. The presence of small amounts of water due to condensation is normal and should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1. Lockwasher
2. Tapping Screw
3. Valve Cover
4. Valve - Ball Check
5. Strainer
6. Jam Nut
7. O Ring - 5.06" O.D.
8. O Ring - 4.685" O.D.
9. Desiccant Cartridge
10. O Ring - 5.75" O.D.
11. Retaining Ring
12. Hose Clamp
13. Elbow
14. Self Locking Nut
15. O Ring - .375" O.D.
16. Valve
17. O Ring - .50" O.D.
18. Spring
19. O Ring - .625" O.D.
20. Plunger
21. O Ring - 15/16" O.D.
22. Cap Nut
23. Heater Retaining Clip
26. Thermostat Retainer
27. Heater & Thermostat
28. Sealing Ring
29. End Cover
30. Retaining Clip
31. Lockwasher
32. Capscrew
33. Lockwasher
34. Hex. Nut
35. Capscrew
36. Safety Valve
37. Elbow
38. Desiccant Plate
39. Housing Assy.
40. Mounting Bracket
42. Pipe Plug - 1/2"
43. Spring
44. Spring Seat
45. Cartridge Bolt

Figure 4-35: Discharge Filter Dryer

not be considered as an indication that the air dryer is not performing properly. The desiccant cartridge should be replaced when it has been determined that the desiccant is contaminated and does not have adequate water absorption capacity. However, the following checks should be made before replacing the desiccant cartridge to ascertain that the water accumulation is not related to the below listed items:

(A) An outside air source has been used to charge the system. This air did not pass through the drying bed.

(B) Air usage exceptionally high and not normal for the vehicle. May be due to accessory air demands or some unusual air requirement that does not allow the compressor to load and unload (compressing and non-compressing cycle).

(C) The air dryer has been installed in the system that has been previously used without an air dryer. This type system will be saturated with moisture and several weeks of operation may be required to dry it out.

(D) Check mounting bolts for tightness. Check all air and electrical connections.

REPLACEMENT OF DESSICANT CARTRIDGE

If it becomes necessary to replace the desiccant cartridge, it is recommended that all o-rings in the housing assembly and purge valve (located at bottom cover) be replaced. The following procedure should be followed.

1. Make certain the vehicle is safely parked. Block wheels if necessary.
2. Drain the air system completely, being sure discharge lines into and out of the air dryer are at atmospheric pressure.
3. Disconnect air line from end cover and mark location of this port on air dryer.
4. Disconnect heater wire.
5. Loosen three capscrews on end cover (29) and turn retaining clamps aside (capscrews may be left finger tight).
6. Locate notch in air dryer shell. While pushing end cover up into dryer, insert blade of screwdriver in notch and slowly pry out retainer ring (11). (If necessary, remove clamp (12) and elbow (13) from exhaust.) Remove end cover assembly and set aside temporarily.
7. Using a 3/4" (19 mm) socket wrench, remove cartridge assembly (9).
8. Remove hex jam nut and nut (6) from cartridge bolt (45) and discard.
9. Remove desiccant plate (38) from desiccant cartridge (9). Desiccant cartridge can be discarded.
10. Remove and discard the two O-rings (7 & 8) from the desiccant plate.
11. Remove screw (2) and retainer (3) from desiccant plate (38) and remove check valve (4). Discard check valve (4).
12. Clean plate assembly in a cleaning solvent, making certain strainer (5), check valve seat and orifice are clean. Dry plate assembly.
13. Install new check valve (4) with retainer (3) and screw (2).
14. Thoroughly lubricate desiccant plate O-rings (7 & 8) with barium lubricate. Install in proper groove of desiccant plate.
15. Install plate assembly over cartridge bolt (45) of new desiccant cartridge (9). Use new nut and join nut to secure plate to desiccant cartridge. **Note:** Screw first nut hand tight against desiccant plate and tighten jam nut against first nut.
16. Wipe inside of air dryer shell clean. If solvent is used be certain that no residue of solvent is left in shell.
17. Check to be certain a film of grease is present on O-rings, push cartridge/plate assembly up into air dryer shell, engage bolt and tighten to 375 inch lbs. (42 Nm) torque.
18. REMOVAL AND REPLACEMENT OF PURGE VALVE, O-RINGS (END COVER ASSEMBLY) **Note:** Clean exterior of end cover assembly before disassembly.
    A. Remove cap nut (22) and discard cap nut O-ring (21).
    B. Place handle of a large screwdriver in vise and secure.
    C. Place slot in plunger (20) (cap nut end) over blade of screwdriver, hold securely and remove nut (14) from plunger (20) with a 1/2" (12 mm) socket.
    D. Remove plunger (20), spring (18) and nylon valve (16). Discard nylon valve.
    E. Clean and inspect bore of end cover (29) and spring (18). Remove and discard three (3) O-rings (15, 17 & 19) from plunger (20). Clean plunger
    F. Lubricate O-rings (15, 17, 19 & 21) and install on plunger (20) and cap nut (22). Lubricate plunge bore.
    G. Install spring (18) and plunger (20) in bore (cap nut end).
    H. Install white nylon valve (16) in bore making certain chamber end of valve is placed in bore first.
    I. Using screwdriver held in vise (as described in "B" & "C") compress plunger (20), install nut (14) and tighten.
    J. Install cap nut (22) and tighten.
19. Check seat for end cover O-rings to be certain it is clean, lubricate O-ring (10), install end cover in dryer shell (39).
20. Position end cover (29) as marked in No. "3", install retainer ring so that gap in ring is within one inch (25.4 mm) of notch in shell.
21. Position retainers so that they contact shell and tighten capscrews. If clamp (12) and elbow (13) were removed, re-install.
22. Mount dryer and tighten capscrews.
23. Connect air lines to air dryer.
24. Connect heater wire.

TROUBLESHOOTING

TROUBLE	CAUSE
COMPRESSOR FAILS TO MAINTAIN SUFFICIENT PRESSURE IN THE AIR SYSTEM.	Dirty intake strainer. Restriction in compressor cylinder head intake or discharge cavities or in discharge valves. Leaking or broken discharge valves. Excessive wear. Drive coupling slipping. Inlet valves stuck open. Worn inlet valves. Excessive system leakage or usage.
NOISY OPERATION	Loose drive coupling. Restrictions in cylinder head or discharge line. Worn or burned out bearings. Worn drive coupling. Compressor not getting proper lubrication. Excessive wear.
COMPRESSOR PASSES EXCESSIVE OIL	Excessive wear. Dirty air intake (Improper air cleaner maintenance). High inlet vacuum. Excessive oil pressure. Oil supply or return lines to compressor flooded. Defective or worn oil seal rings in end cover. Piston rings not properly installed. Back pressure from engine crankcase.
COMPRESSOR NOT UNLOADING	Defective unloader pistons or bores. Intake cavity restrictions. Defective governor. Unloader line or cavity to governor restricted. Unloader mechanism binding or stuck.
INSUFFICIENT BRAKES	Brakes need adjusting, lubricating or relining. Low air pressure in brake system (below 80 pounds). Brake valve delivery pressure below normal.
BRAKES APPLY TOO SLOWLY	Brakes need adjusting or lubricating. Low air pressure in the brake system (below 80 pounds) Brake valve delivery pressure below normal. Excessive leakage with brakes applied. Restricted tubing or hose line.

TROUBLESHOOTING (Cont'd)

TROUBLE	CAUSE
BRAKES RELEASE TOO SLOWLY	Brakes need adjusting or lubricating. Brake valve not returning to fully released position. Restricted tubing or hose line. Exhaust port of brake valve or quick release valve restricted or plugged. Defective brake valve or quick release valve.
BRAKES DO NOT APPLY	No air pressure in brake system. Restricted or broken tubing or hose line. Defective brake valve.
BRAKES DO NOT RELEASE	Brake rigging binding. Brake valve not in fully released position. Defective brake valve Restriction in tubing or hose line.
UNEVEN BRAKES	Brakes need adjusting, lubricating, or relining. Grease on brake lining - reline brakes. Brake shoe release spring or brake chamber release spring broken. Brake drum out of round. Brake chamber diaphragm leaking.
AIR PRESSURE WILL NOT RISE TO NORMAL	Defective air gauge (registering incorrectly). Excessive leakage. Reservoir drain cock open. Governor out of adjustment. No clearance at compressor unloading valves. Defective compressor.
AIR PRESSURE RISES TO NORMAL TOO SLOWLY	Excessive leakage. Clogged air cleaner. No clearance at compressor unloading valves. Engine speed too low. Compressor discharge valve leakage. Worn compressor. Excessive carbon in compressor cylinder head or discharge line.
AIR PRESSURE RISES ABOVE NORMAL	Defective air gauge (registering incorrectly). Compressor governor out of adjustment. Defective compressor governor. Restriction in line between governor and compressor unloading mechanism. Too much clearance at compressor unloader valves. Unloading valve cavities or unloading passage in compressor cylinder head blocked with carbon. Compressor unloading valves stuck closed.

TROUBLESHOOTING (Cont'd)

TROUBLE	CAUSE
AIR PRESSURE DROPS QUICKLY WITH ENGINE STOPPED AND BRAKES RELEASED	Leaking brake valve. Leaking tubing or hose line. Compressor discharge valves leaking. Compressor governor leaking. Excessive leakage elsewhere in the air brake system.
AIR PRESSURE DROPS QUICKLY WITH ENGINE STOPPED AND BRAKES FULLY APPLIED	Leaking brake chamber or roto chamber diaphragm. Leaking brake cylinder. Leaking brake valve. Leaking tubing or hose line.
BRAKES GRAB	Grease on brake lining - reline brakes. Brake drum out of round. Defective brake valve. Brake rigging binding.
COMPRESSOR KNOCKS CONTINUOUSLY OR INTERMITTENTLY	Loose drive gear. Worn or burnt out bearings. Excessive carbon deposits in compressor cylinder head.
SAFETY VALVE "BLOWS OFF"	Safety valve out of adjustment. Air pressure in the air brake system above normal.

SPECIFICATIONS

AIR COMPRESSOR

Make	Bendix Westinghouse
Model	Tu Flo 600
Number (STD.)	280369
Number (Optional)	282457
Capacity (at 1250 RPM)	14.5

INLET VALVE SEAT

Worn Groove Not to Exceed	If grooved, replace

DISCHARGE VALVE SEAT

Worn Groove Not to Exceed	Discharge Valve Travel not to Exceed .050
Piston Ring gap (In Cylinder)	.005 min. to .015 max.
Piston Ring Clearance (In groove)	.0015 min. to .0035 max.
Narrow Ring	.002 min. to .004 max.
Wide Ring	.0035 min. to .0055 max.

SPECIFICATIONS (Cont'd)

Clearance between Piston and Cylinder Wall	Cast Iron (.0020 to .0035)
Cylinder Bores	
Max. allowable out-of-round	.002
Max. allowable Taper	.003
Crankshaft Seal Ring Gap (In Crankshaft)	.000" to .005" when set in .998" Dia. Gage
Crankshaft Journal Max. (Out-of-Round)	.003
Clearance between connecting rod bushing and Piston Pin (Ream) Max. allowable Clearance	.0002 to .0007
Discharge Valve Travel with new Valves, Springs, and cap nuts—Between	.030 to .046
Clearance Between Connecting Rod Bearing and Crank Shaft Journal (After Rebuild)	.0003 min. to .0021 max.
Inlet Valve Spring	236126
Free Height	29/64
Height under load of at 3/8"	3.3 oz. max., 2.7 oz. min.
Unloader Valve Spring	239972
Free Height	3/4
Height under load of	1 lb. 6 oz. 45/64
Discharge Valve Spring	210468
Free Height	1 7/64
Height Under Load Of	1.072 at .25 lbs. to .75 lbs.

GOVERNOR

Make	Bendix-Westinghouse
Model	D-2
Cut-In Pressure	95-105 P.S.I.
Cut-Out Pressure	115-118 P.S.I. max.
Exhaust Valve Travel	.060 to .093"
Inlet Valve Travel	.030-.040"

BRAKE CHAMBERS

	FRONT	REAR	TRAILING
Make	Bendix Westinghouse	Bendix Westinghouse	Bendix Westinghouse
Type	24	30	12
Diameter	7-1/4	8-1/8	5-21/32
Spring Force at O Stroke	30-3/4	39	12-1/4
Spring Force Increase per Inch of Stroke	8	5	2-1/2
Maximum Stroke	2-1/4	3	1-3/4
Minimum Stroke (with brake adjusted)	1-3/4	1-1/2	1-3/8
Effective Diaphragm Area..	24	30	12

SPECIFICATIONS (Cont'd)

SLACK ADJUSTERS

	FRONT	REAR
Model No.	278112-L.H. 278111-R.H.	279697-L.H. 279698-R.H.
Make	Bendix Westinghouse	Bendix Westinghouse
Type	20	20
Length Between Hole Centers	7"	7"
Number of Splines	10	10
Bushing—Width	.520	.520
Inside Diameter	.540 .000-.001	.504 .000-.001
Outside Diameter	.628 .000-.001	.628 .000-.001
Spring—Free Length	1"	1"
Compressed Length	3/4"	3/4"

VALVE SPRINGS

Pressure Regulator Valve Spring	
Free Length	2-13/16"
Compressed Length	2"
Relay Valve Spring	
Free Length	1-11/32"
Compressed Length	63/64"
Check Valve Spring	
Free Length	11/16"
Compressed Length & Pressure	3/8"
Brake Application Valve Piston Return Spring	
Free Length	2-11/32
Compressed Length	1-3/4
Valve Spring	
Free Length	49/64
Compressed Length	41/64
Quick Release Valve Spring	
Free Length	1-35/64
Compressed Length	1-7/32

AIR LINE CHECK VALVE

Make	Bendix Westinghouse
Model No.	229603
Air Pressure Differential	2 lbs.

PRESSURE REGULATING VALVES

LAVATORY DOOR CONTROL

Make	Williams
Model No.	WM-279-E
Pressure Settings	21 P.S.I.
* Color	Red

LAVATORY AIR FLUSH (OPTIONAL)

Make	Williams
Model No.	WM-279-E1
Pressure Setting	11 P.S.I.

ALTERNATOR BELT TENSION

Make	Williams
Model No.	WM-279-E
Pressure Settings	21 P.S.I.
* Color	Red

HIGH SPEED ALTERNATOR PULLY (OPTIONAL)

Make	Williams
Model No.	WM-279-E1
Pressure Setting	27 P.S.I.

BLOWER BELT TENSION

Make	Williams
Model No.	WM-279-E
Pressure Settings	21 P.S.I.
* Color	Red

TRAILING WHEEL BELLOWS

Make	Williams
Model No.	WM-279-E
Pressure Settings	35 P.S.I.
* Color	Blue

TRAILING AXLE UNLOADING SYSTEM (OPTIONAL)

Make	Williams
Model No.	WM-279-E1
Pressure Setting	15 P.S.I.

A/C COMPRESSOR BELT TENSION

Make	Williams
Model	WM-279-E
Pressure Settings	56 P.S.I. changed to 95 P.S.I. Eff. Unit No. 10670
* Color	Green

PARKING BRAKE

Make	Williams
Model No.	WM-279-E
Pressure Settings	85 P.S.I.
* Color	Yellow

* Effect. In Production on Coaches with Unit #10098 to 10827

SPECIFICATIONS (Cont'd)

WINDSHIELD WIPER (Discontinued Eff. Unit #10827)

Make	Williams
Model No.	WM-279-E
Pressure Settings	85 P.S.I.
* Color	Yellow

* Effect. In Production on Coaches with Unit #10098 to 10827

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

CLUTCH

(6 LEVER LONG)

DESCRIPTION

The clutch is a two-plate dry disc type, 15" in diameter. A center drive plate is installed between the two driven discs. Driven discs use spring vibration dampeners. The clutch plates are held in the engaged position by a series of all coil springs which act on the pressure plate.

To reduce the effort required to disengage the clutch, an air assist mechanism is provided. This is described in detail later in this section.

Clutch parts are housed in a clutch housing which is attached to the transmission case.

MAINTENANCE

Periodic maintenance of the clutch assembly consists of regular lubrication of the clutch release bearing by means of Zerk fitting. Lubrication intervals and recommended lubricant are outlined in Section 10 (Lubrication) of this manual.

FREE TRAVEL ADJUSTMENT

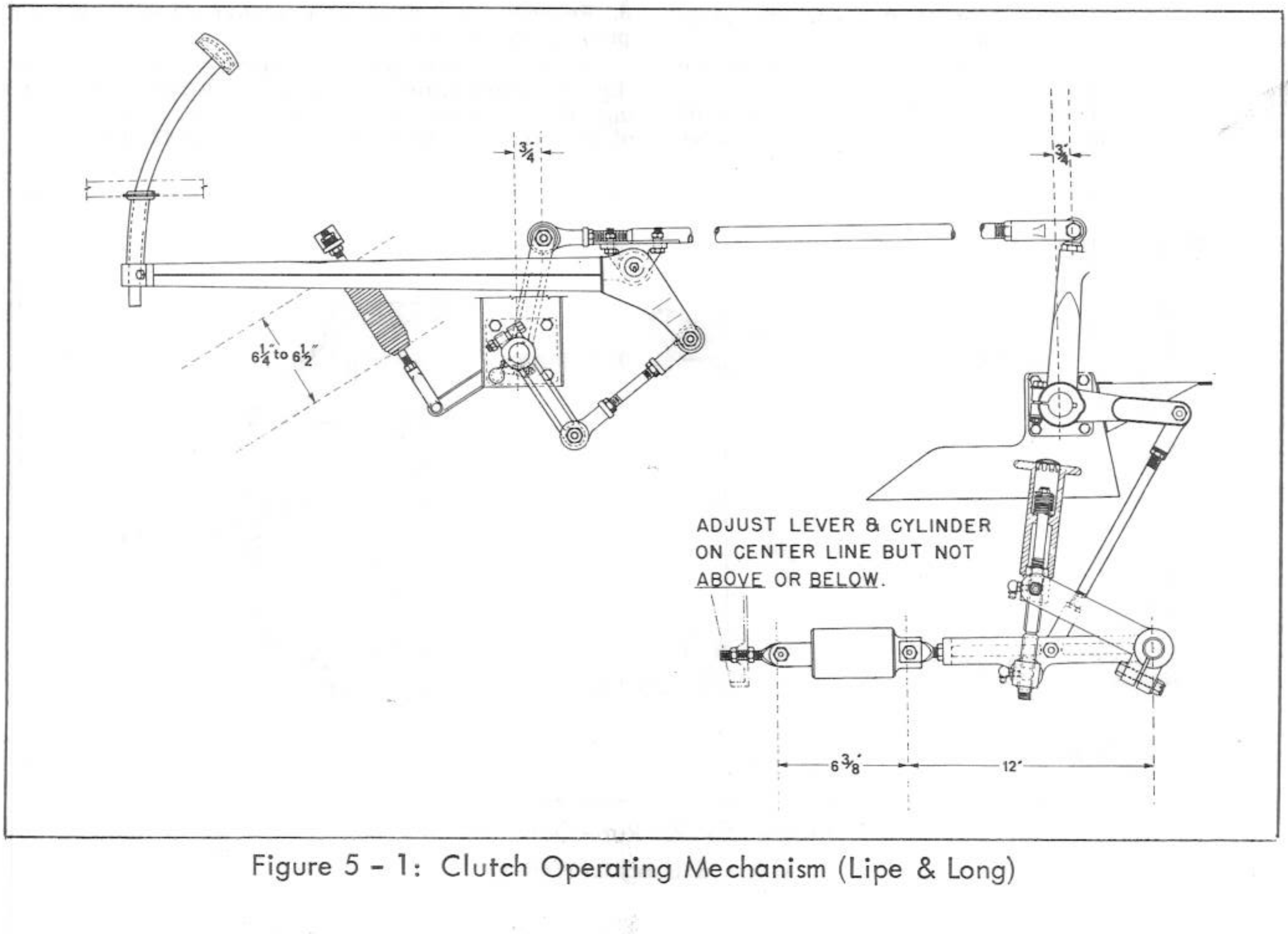
Before adjustments are made to clutch free travel, inspect clutch operating linkage for worn or defective parts.

Free travel is adjusted by means of an adjusting handle that is accessible from the left hand engine service compartment. Procedure for adjusting the clutch release bearing clearance is as follows:

Lift and tighten adjusting handle until pressure is felt.

Back off one full turn using key numbers on handwheel as a guide and drop handle down on the lock.

A free travel of approximately 1-1/2" should be maintained at the clutch pedal by adjusting the release bearing 1/8" to 5/32" clearance. Free travel should be checked and adjusted every 2,500 miles, or more often if necessary. This will ensure that the clutch release bearing does not contact the



ADJUST LEVER & CYLINDER ON CENTER LINE BUT NOT ABOVE OR BELOW.

Figure 5 - 1: Clutch Operating Mechanism (Lipe & Long)

release forks when the clutch is engaged, and that no clutch slippage takes place. The service interval at which this operation will be necessary will depend on the type of service.

LINKAGE ADJUSTMENT

The clutch linkage is factory set to correct dimensions as indicated in figure 5-1. Other adjustments need not be made at any other points. If adjustments through the linkage are changed, the linkage geometry will change and cause problems in free travel or clearance between release bearing and finger buttons.

REMOVAL AND REPLACEMENT

The Clutch Assembly may be replaced without the engine assembly removed from the coach. The Transmission Dolly is used to allow removal and replacement of clutch as described in the following page under the "TRANSMISSION REMOVAL AND INSTALLATION PROCEDURE."

DISASSEMBLY

1. Mark the relationship of the cover plate assembly to the flywheel before removal in order that these components may be reassembled in the same position.
2. Insert six capscrews (3/8" - 16 x 2" threaded 1") through cover stamping holes and screw into pressure plate to retract. This procedure will relieve pressure spring load so that cap-screws attaching the clutch to the flywheel can be easily removed.
3. Insert a suitable aligning arbor or old clutch shaft to support the driven disc while the clutch cover assembly is being removed.
4. Remove the capscrews holding the clutch to the flywheel. If necessary, tap flange of clutch cover with a soft mallet to free the assembly from the flywheel. The cover assembly, driven disc, and drive plate can then be removed.
5. The flywheel wear plate may now be removed by removing the twelve capscrews which attach the plate to the flywheel.

CLUTCH COVER PLATE

If the cover plate assembly is to be rebuilt, first mark the relationship of the pressure plate to the cover so that it may be reassembled in the same position to avoid disturbance to the balance.

To disassemble clutch components, an arbor press should be used.

1. Place the clutch assembly face down under the press with a bar across the top of the cover clearing all nuts and screws.
2. Compress the cover until levers start to depress, then remove the twelve nuts holding the thrust plates and remove the six lever adjusting nuts.
3. Release arbor press and remove clutch cover off pressure plate assembly.

If the pressure plate is scored, warped, or heat checked, remachine face by either turning or grinding. If it is necessary to remove more than 1/16" of material in order to provide a satisfactory face,

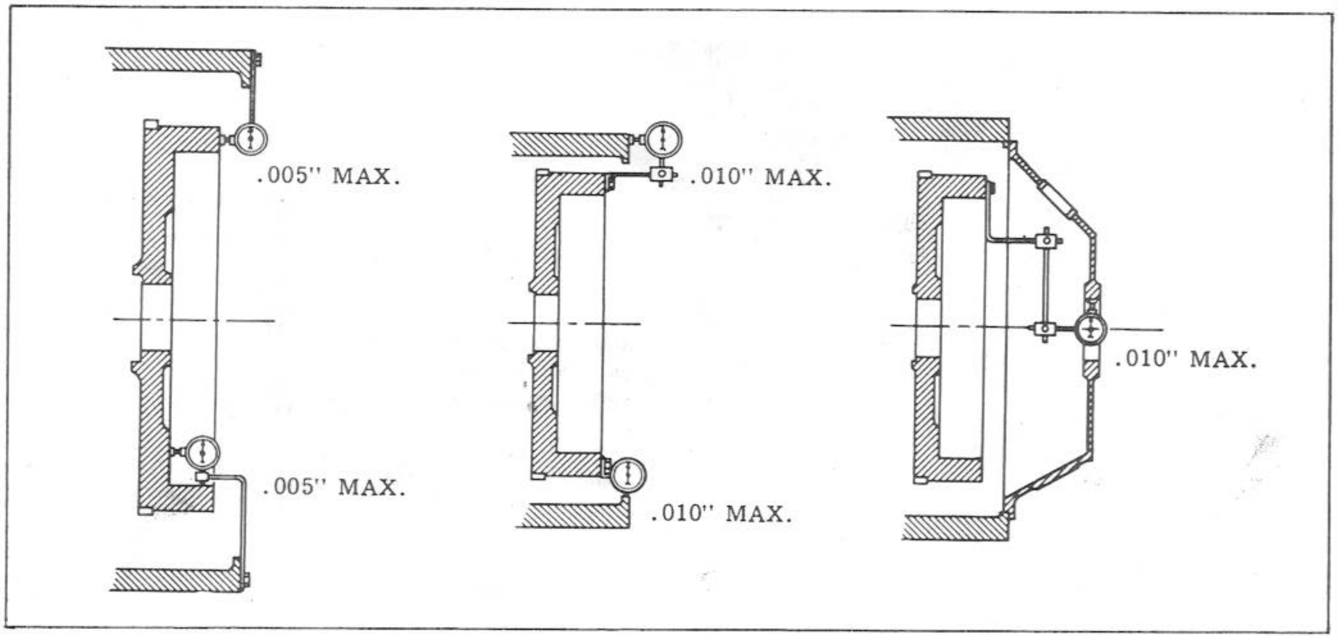
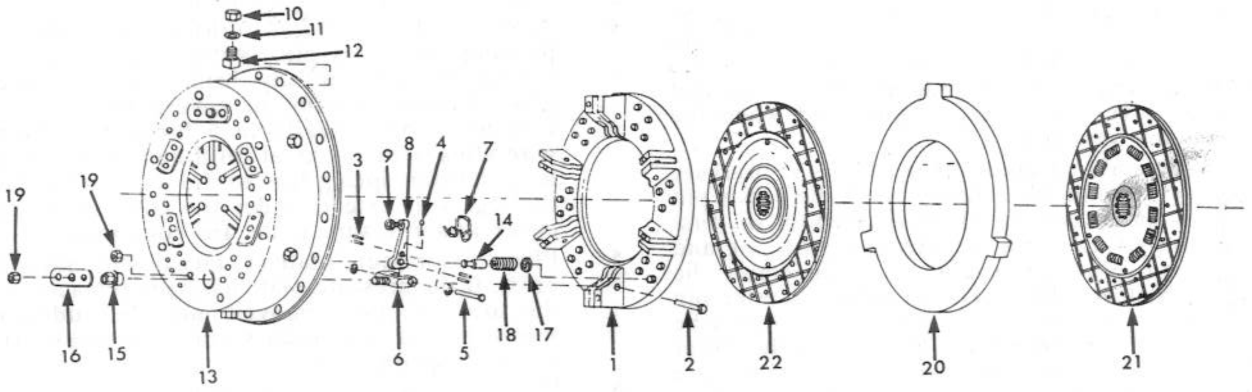


Figure 5 - 2: Run-Out Checks
(Lipe & Long Clutches)



1. Pressure Plate
2. Release Lever Pin
3. Release Lever Needle Roller
5. Release Lever Pin
6. Release Lever Yoke
7. Release Lever Spring
8. Release Lever
9. Lever Thrust Button
10. Hex. Nut - 7/16-20
11. Lockwasher - 7/16 Med.
12. Drive Block
13. Cover Plate
14. Pressure Spring Locator
15. Release Lever Adjusting Nut
16. Thrust Plate
17. Pressure Spring Insulator Washer
18. Pressure Spring
19. Self-Locking Nut - 5/16-24
20. Center Drive Plate Assy.
21. Drive Member Assy. - Rear to Engine Flywheel
22. Driven Member Assy. - Front to Trans.

Figure 5-3: Clutch Assembly

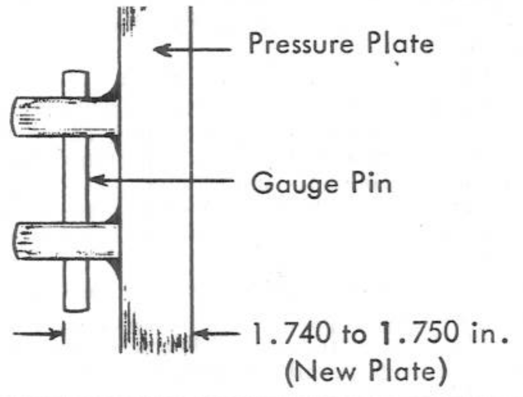


Figure 5-4: Measurement of Pressure Plate Thickness

the plate should be replaced. Care should be taken in machining to cut the face of the plate parallel with the clevis pin holes in the driving lugs, otherwise difficulty may be encountered in setting the levers to the proper height. Remachining is recommended only where the proper equipment is available.

If the plate is not scored or heat checked badly, it can be cleaned using emery cloth and washed in carbon tetrachloride before reinstalling.

CAUTION: The total amount of metal removed from the pressure plate and center drive plate must be compensated for by placing shims under the pressure springs when rebuilding the cover plate assembly.

If the release lever buttons are worn to a nearly-flat pattern at the point of contact with the release

bearing, they should be replaced. Refer to Figure 5 - 3 unless otherwise specified.

If the lever or yokes are to be removed from the pressure plate, dummy pins, 5/16" in diameter by 5/8" long, are required for reassembly. These are placed in the lever holes and the needle rollers (3) assembled around them. The dummy pins are pushed through the lever and out the other end when the clevis pins are inserted.

1. In disassembling the lever (8) from the pressure plate (1), grind the staked end of the clevis pin (2) on clutch assemblies overhauled for the first time only flush with the pressure plate lug and drive out pin with a drift. To disassemble the yoke (6) from the lever (8), remove cotter pin (4) and drive out the pin (5). Levers should be examined for brinelling in the needle roller holes. Worn release lever buttons (9) are removed by pressing out and pressing in new release buttons.
2. Flywheel run-out should be checked with the flywheel in position on the engine. This may be done using a good dial indicator as shown in Figure 5-2. If run-out readings exceed those indicated, corrections should be made. Run-out should be corrected by remachining. The use of shims to correct this condition is not recommended.
3. The driven disc hub splines should be checked for excessive wear. After relining, the driven disc should be checked for run-out. If run-out exceeds .025", the clutch may not release when reassembled. The installation of complete new driven discs is preferred to replacing clutch facings.

Proper balance of clutch driven discs and center plate is important for satisfactory operation. Maximum out-of-balance tolerance for the driven discs is 1/2 oz. and for the center plate is 1/4 oz.

4. Clutch pressure springs (18) should be checked carefully for specified load at the specified height. If compressed spring pressure is less than 139 lbs. at 1.888", the springs should be replaced. If the face of the pressure plate has been remachined, a metal spacer equal in thickness to the amount of metal removed in remachining should be placed under each pressure spring. Pressure springs should be replaced if they appear to have been overheated or if they are suspected of being defective for any other reason.
5. The center drive plate (20) may be remachined, but not more than 1/16" of metal should be removed. If more than this amount must be removed to eliminate scoring, heat checking, or warpage, the plate should be replaced with a new part.

1. If the levers have been disassembled, place the dummy pin in the needle roller holes and assemble the rollers (3) around the pin. Refer to Figure 5-3. Care should be taken that the rollers in the holes are straight and that a full complement of fourteen rollers are in each hole.
2. The yoke and lever tension spring should be assembled to the lever first by pushing the clevis pin through the hole and pushing the dummy pin out the opposite end.
3. Insert and spread cotter pins.
4. Assemble the lever unit to the pressure plate by pushing the clevis pin. **Note:** New clevis pins should be used if any brinelling has taken place. In reassembling the coverplate, it is convenient to have available 6 horseshoe-shaped wire slips with hooks at both ends to hold the lever tension spring legs to the lever, otherwise the legs will extend under the cover when the cover and pressure plate are compressed.
5. Place the pressure plate (1) face down under the press. If the pressure plate has been remachined, the total amount removed must be added in shims, placed over each spring boss before the pressure springs (18).
6. Place the cover over the springs, being sure to line up marks made before disassembly.
7. Compress slowly making sure that the driving lugs on the pressure plate guide themselves into the drive slots in the cover and threaded yoke ends are lined up with holes in top of cover.
8. Screw down the six lever adjusting nuts until yoke end is flush with nut.
9. Place the six thrust plates in place and put on attaching nuts, do not tighten down.
10. Release press.

The cover plate assembly is now ready for final lever adjustment, and this should be made on the flywheel.

Inspect pilot and release bearings to make sure they are in good condition. If excessively worn, replace. Before installation, lubricate with a good grade of high-melting-point grease. **CAUTION:** Do not over-lubricate.

11. Install clutch facing marked "Flywheel Side" with marking towards flywheel. Check dust shield if also on same side.
12. Install steel clutch member with machined side of drive lugs towards transmission. Check that drive lugs are not binding in the flywheel slots and the flywheel slots are machined deep enough.
13. Install second clutch plate marked "Transmission Side". Dust shield should be on same side as marking and should be installed in that position.
14. Install pilot shaft to align plates.
15. Install 6 - 3/8 x 2" retractor screws in cover plate and install cover plate using 18 - 3/8 x 1 capscrews with lockwashers. Tighten capscrews by using opposite point method with final tightening of each in clockwise rotation. Make sure pressure cover plate fits evenly on flywheel.
16. Remove retractor screws from cover plate.
17. Check finger position with gauge. Fingers should be adjusted 1-3/8" below cover. Before adjusting, check all six finger positions. They should be even within 1/8". If one finger is either high or low more than 1/4", recheck for mis-installed clutch plates or shipping bolt not removed. Refer to Figure 5-3.

CLUTCH

(3 LEVER LIPE)

DECSRIPTION

The Lipe Type DP (direct pressure) clutch is a two plate dry disc type, 15" in diameter.

To reduce the effort required to disengage the clutch, an air assist mechanism is provided. This is described in detail later in this section.

Clutch parts are housed in a clutch housing which is attached to the transmission case.

MAINTENANCE

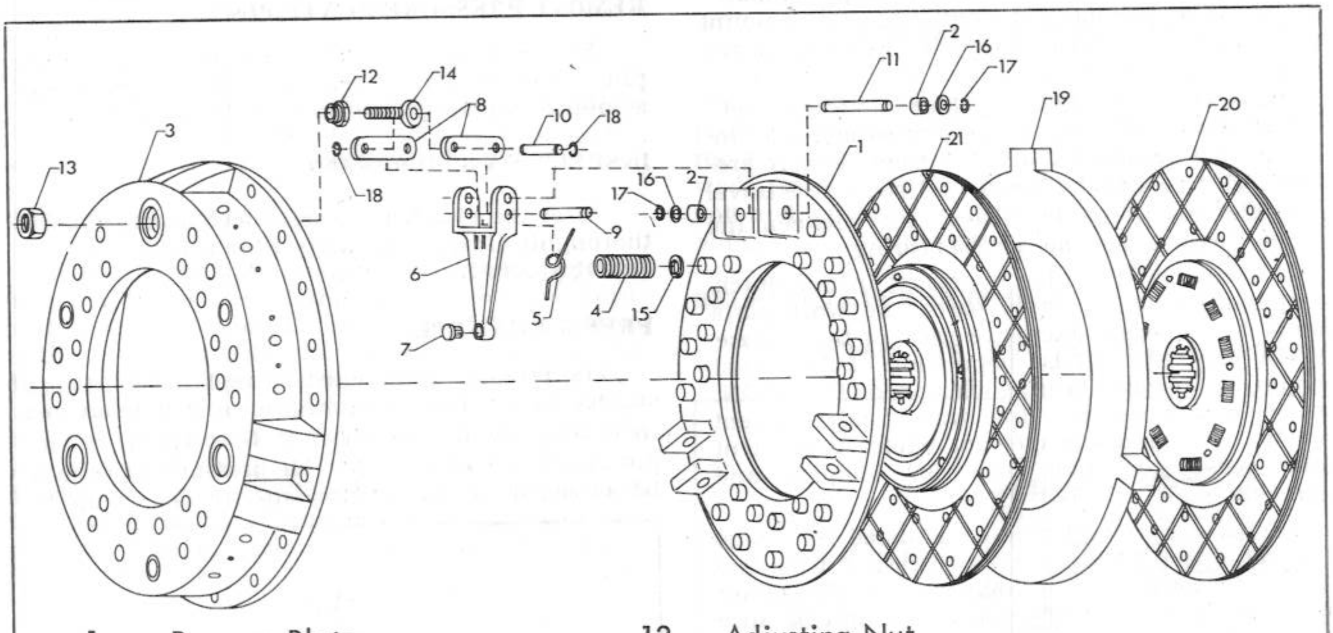
Periodic maintenance of the clutch assembly consists of regular lubrication of the clutch release bearing by means of Zerk fitting. Lubrication intervals and recommended lubricant are outlined in Sect' 10 (Lubrication) of this manual.

OPERATION

The clutch flywheel ring (cover) (3) is attached to the engine flywheel and drives the pressure plate (1) by means of driving lugs in the flywheel ring (cover) (3) and mating slots in the pressure plate (1).

Depressing the clutch pedal disengages the clutch, by allowing the release bearing to contact and move the release levers (6) toward the engine flywheel resulting in the pressure springs (4) being compressed and the pressure plate (1) being retracted away from the disc assembly (20), thereby, disengaging the clutch.

Releasing the clutch pedal engages the clutch



1. Pressure Plate
2. Needle Bearings
3. Flywheel Ring (Cover)
4. Pressure Spring (Purple Stripe)
5. Retractor Spring
6. Release Lever
7. Release Lever Button
8. Link
9. Pin (Link-Lever)
10. Eye Bolt Pin
11. Pressure Plate Pin
12. Adjusting Nut
13. Lock Nut
14. Eye Bolt
15. Insulating Washer
16. Washer - Pressure Plate Pin
17. Retaining Ring
18. Snap Ring (Eye Bolt Pin)
19. Intermediate Plate
20. Driven Disc Assy. (Flywheel Side)
21. Driven Disc Assy. (Pressure Plate Side)

Figure 5 - 5: Clutch Assy. (3 LEVER LIPE)

levers. If release buttons are worn, replace with new buttons.

LINKS

If holes are worn or elongated, replace links.

PRESSURE PLATE PIN AND LINK LEVER PIN

If worn replace.

DISC ASSEMBLIES

The disc assemblies should be replaced if the following conditions are present: Hub splines are worn. Discs are distorted and if discs are cracked or broken. If refacing is done make sure the proper riveting method is used. Refer to Figures 5-9 & 5-10 for proper riveting. Figure 5-9 shows the method or riveting fabric facings, using a star set anvil, resulting in the split end of the rivet conforming to the tapered counterbore of the facing. The rivet is seated firmly, thereby preventing loose facings Figure 5-10 shows the incorrect method of riveting, using a roll or eyelet anvil, resulting in small contact area, and damage to the facing. This type of riveting will result in the facing working loose; as the rivets are not seated properly.

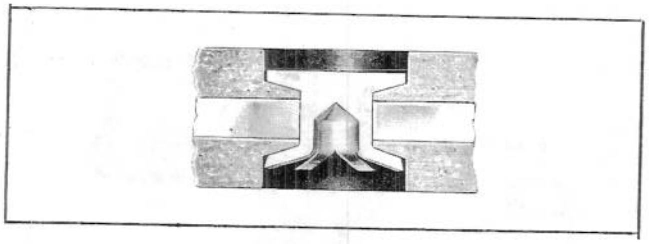


Figure 5-9: Correct riveting for fabric or semi-metallic facings

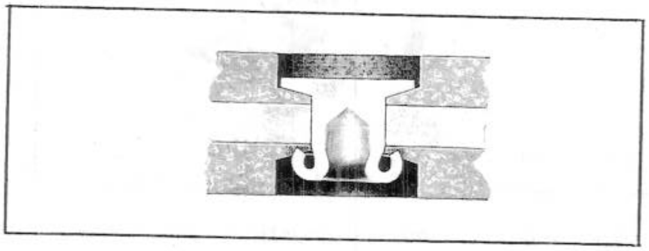


Figure 5-10: Correct riveting for metallic facings

LUBRICATION

Place a small amount of high melting point grease on the driving lugs of the flywheel ring (cover) and mating slots in the pressure plate, as well as all Pins. CAUTION: Do not over-lubricate.

ASSEMBLY OF CLUTCH

DESCRIPTION

Place pressure plate on an arbor press or rebuilding machine friction surface down.

Assemble adjusting nut to eyebolt assembly so that 3 or 4 threads are showing on the inside of the adjusting nut. Use new links only and assemble to eyebolt assembly, install same to release lever assembly using link lever pin, Refer Figure 5-8. At this point install retractor spring with the hook end seated in groove of lever, running under eyebolt assembly to groove in pressure plate. Then assemble to pressure plate inserting pressure plate pin through coiled loop of retractor spring. Make sure the cotter pin hole of pressure plate pin is parallel to pressure plate and install cotter pin. Refer Figure 5-11.

Place insulating over bosses on plate and install pressure springs. Refer Figure 5-12.

Place flywheel ring (cover) over assembly. If original flywheel ring (cover) and pressure plate are used, lined up driving lugs marked "O" with driving slot marked "O". To facilitate assembly,

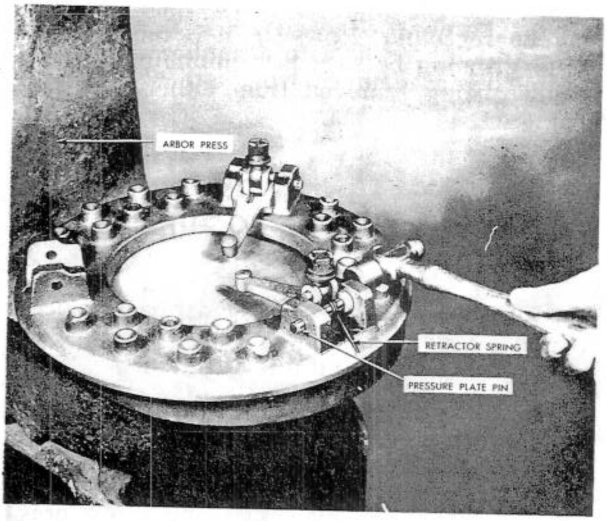


Fig. 5-11: Assembling Release Lever Assy. to Pressure Plate

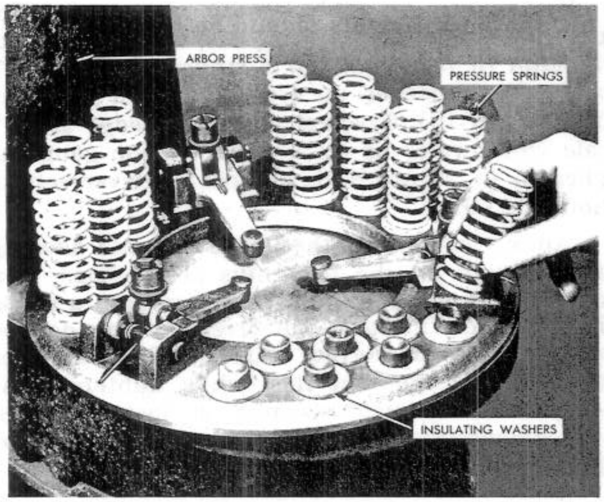


Fig. 5-12: Installing Insulating Washers and Pressure Springs

install guide bolts into adjusting nut until contact is made with end of eyebolt. Refer Figure 5-13. The 15'' clutches use 9/16-18 x 3'' capscrews. Compress flywheel ring cover gradually, making sure that the three driving lugs enter properly in the driving slots in the pressure plate, and the pressure springs are properly seated on the pressure plate and in the seats provided in the flywheel ring (cover).

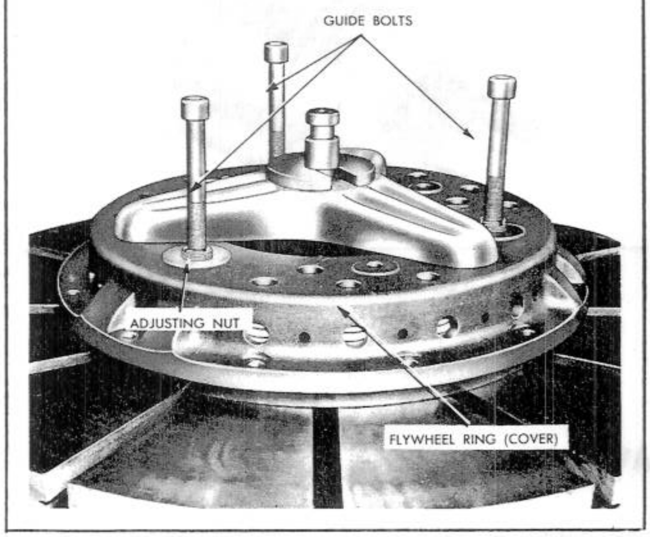


Fig. 5-13: Installing Flywheel Ring (Cover) and Guide Bolts

Pull the adjusting nut through holes in the flywheel ring (cover) with the guide bolts previously installed.

Remove the guide bolts and assemble adjusting screw locknuts, making sure they are drawn tight to cover. Refer Figure 5-14.

Install hold-down 3/8 - 16 x 2-1/2'' and 3/8'' standard washer in holes provided in flywheel ring (cover), and tapped holes in pressure plate (3 required), Refer Figure 5-14. For an alternate procedure use 7/16'' wood block between the release lever and underside of cover.

The press or rebuilding machine can now be release and the clutch cover assembly removed.

CLUTCH INSTALLATION

INSPECT ENGINE FLYWHEEL

Check flywheel for correct depth, it should be 2.582'' + .005''. Make sure release bearing and flywheel pilot bearing are in useable condition. Pilot bearing should be a finger press fit in flywheel and on transmission drive shaft. Friction face of flywheel should be smooth and clean. CAUTION: The friction face of the flywheel must be free from heat cracks, score marks and foreign matter, as the presence of any one of these conditions will cause the clutch facings to quickly disintegrate.

INSTALLING CLUTCH ASSEMBLY

Try cover assembly in flywheel before inserting

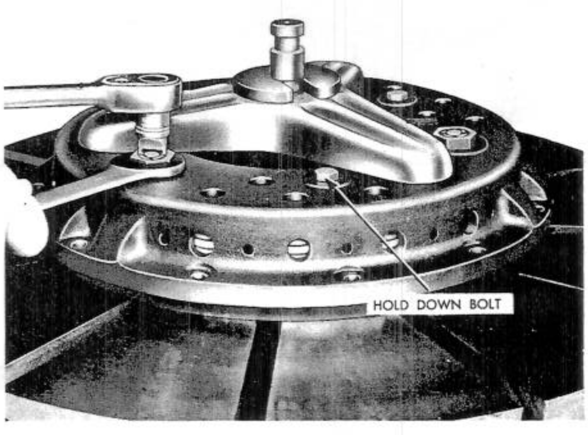


Fig. 5-14: Installing Adjusting Screw Locknuts and Hold Down Bolts

driven disc assembly, so as to make sure it is a free fit in the flywheel. Install driven disc assembly in the engine flywheel, making sure long end of hub faces clutch cover assembly. To facilitate the assembly of the transmission to the engine the use of a spare splined pilot shaft to align the driven disc assembly while bolting the clutch in place is essential. The side of the clutch driven disc assembly that faces the clutch pressure plate, has a chamber on the end of the splined hub to facilitate the insertion of the transmission drive shaft.

Bolt the clutch assembly to the flywheel and screw in each bolt until it contacts cover plate assembly. Then gradually tighten opposite bolts until assembly is drawn tight and completely into flywheel. Remove hold down bolts previously installed.

NOTE: It is very important that the correct capscrews be used when attaching the cover assembly to the flywheel.

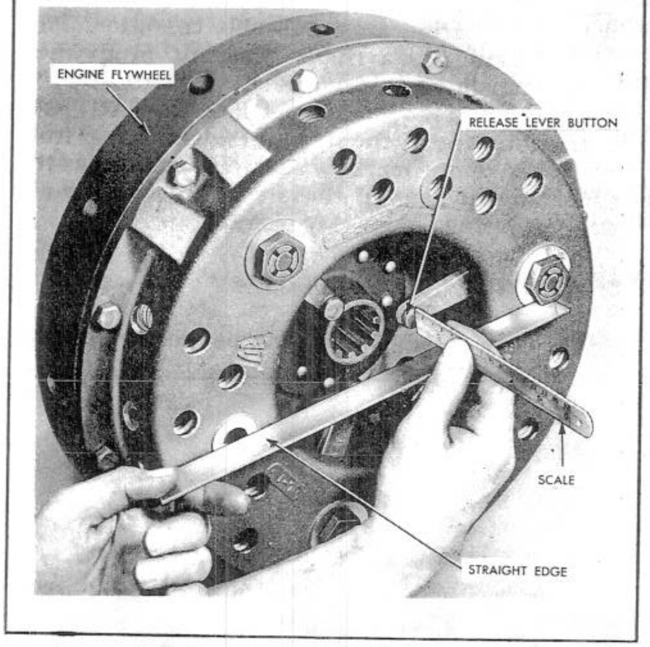


Fig. 5 - 15: Checking Dimension "A"

If the cover assembly has been repaired or rebuilt, the lever heights should be checked after installation in the flywheel, a straight edge and 6" scale will service as an 1/4" dimension gauge as stallation in the flywheel, a straight edge and 6" scale will service as an 1/4" dimension gauge as indicated in Figure 5-15. The correct lever setting should be 1-3/8".

Always start with the levers low and keeping some tension on the lock nuts at all times, turn both the lock nut and the adjusting nuts in a clockwise direction to raise the levers to the desired setting. When the correct height has been obtained hold the adjusting nut firm while tightening the lock nut. New Cover assembly or factory rebuilt cover assemblies are preadjusted at the factory and will not require further adjustment.

DIMENSION A

Check for proper Dimension "A". Satisfactory operation of the clutch is absolutely dependent upon the accuracy of the release lever adjustment, since the pressure plate must operate parallel with the engine flywheel. Set the release levers to proper Dimension "A" by turning adjusting nuts and measuring with a straight edge and scale. The release lever buttons should be the same distance from the ground surface of the bosses on the flywheel ring (cover). After Dimension "A" has been set, tighten locknuts securely, at the same time holding the adjusting nut from turning. Use tool T10207A for holding slotted adjusting nut. Refer Figure 5-16.

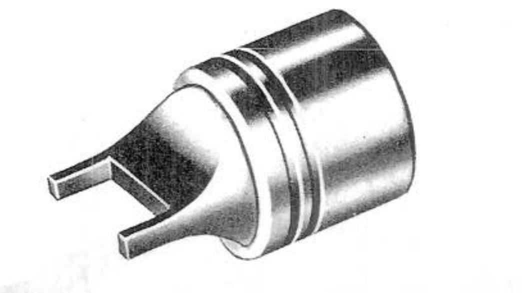
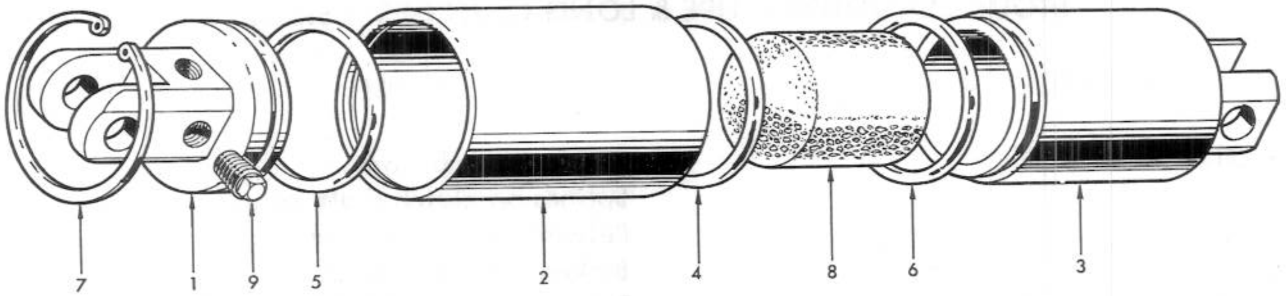


Fig. 5 - 16: Tool for Slotted Adjusting Nut

DP RELEASE TRAVEL CHART

CLUTCH SIZE & TYPE	RELEASE BEARING CLEARANCE	NORMAL RELEASE BEARING TRAVEL	TOTAL BEARING TRAVEL REQ'D.
15" Two Plate	1/8"	1/2"	5/8"



1. Yoke End Plate	6. "O" Ring - Cylinder
2. Cylinder	7. Retaining Ring
3. Piston	8. Sponge Oiler
4. Packing - For Piston	9. Brass Plug
5. "O" Ring - Yoke End Plate	

Fig. 5 - 17: Clutch Air Cylinder (Long & Lipe Clutches)

CLUTCH AIR CYLINDER (LIPE & LONG CLUTCHES)

DESCRIPTION

The clutch air cylinder consists of a single-acting air cylinder and suitable linkage mounted on the right-hand side of the transmission case. Refer to Figure 5-17.

The air cylinder is under pressure at all times. Thus pressure is applied to the clutch release mechanism by the air cylinder. To disengage the clutch, as the clutch pedal is depressed, the air cylinder acts in the direction of arm travel for clutch disengagement. As the clutch pedal is depressed further, the air cylinder continues to apply force on the release arm, reducing the effort required to disengage the clutch.

MAINTENANCE

It is recommended that the clutch air cylinder be lubricated at regular intervals—approximately every 30,000 miles. The recommended procedure is as follows: Remove air feed hose and put in a few drops of SAE 30 oil into cylinder through air hose connector. Reconnect the feed hose, then reverse the air supply to the cylinder, this will lubricate the other end of the cylinder. Check air cylinder for leaks. It should also be noted that when overhauling air cylinder, it is important to replace all seals, felts, cups and "O" rings with new parts for proper operation. Also when overhauling cylinder the new parts should be coated with oil before assembly.

ADJUSTMENT

Centerline through air cylinder and lever arm should be maintained when clutch is fully engaged. The distance between cylinder end centers should be 6-3/8". Distance between clutch housing cross shaft and air cylinder end should be 12". Refer to Figure 5-1.

TROUBLESHOOTING—LIPE & LONG CLUTCHES

TROUBLE	CAUSE
NOISE	Release or pilot bearing needs lubrication or is worn out Clutch parts binding. Springs in flexible center of driven discs weak or broken.

TROUBLESHOOTING—LIPE & LONG CLUTCHES (Cont'd)

TROUBLE	CAUSE
NOISE (Cont'd)	Splines on hub worn.
	Splines on clutch shaft worn.
	Release sleeve dry or worn.
	Broken release yokes.
	Release bearing riding release levers.
SQUEAKS	Pedal return spring at hooked ends - or over-center spring - lubricate at hooks.
	Scrubbing action between pressure plate and drive slots or lugs - lubricate at lugs.
	Release bearing not on collar square - repair.
SLIPPAGE	Worn facings.
	No free travel at pedal.
	Grease on facings.
	Linkage improperly adjusted.
	Weak or broken pressure springs.
	Distorted pressure plate.
	Release bearing riding release levers.
	Pressure plate binding on studs.
	Clutch parts binding.
GRABBING	Worn facings.
	Distorted pressure plate.
	Distorted clutch shaft.
	Flattened or distorted driven discs.
	Misalignment of bellhousing.
	Grease on facings.
	Pressure plate binding on studs.
	Dust in flywheel.
	Clutch parts binding.
	Release bearing carrier binding on sleeve.
CHATTER	Grease on facings.
	Bad motor mounts.
	Worn fork.
	Worn release bearing.
	Facing dust in flywheel.
	Uneven release levers.
	Cracked on broken pressure plate.
	Facings worn.
	Facings glazed.
	Warped or grooved pressure plate.
	Release bearing carrier binding on sleeve.

TROUBLESHOOTING-LIPE & LONG CLUTCHES (Cont'd)

TROUBLE	CAUSE
NON-RELEASE OR DRAG	Grease on facings. Linkage improperly adjusted or worn. Release levers out of adjustment. Insufficient pedal travel or bearing travel. Clutch hub binding on shaft. Splines on transmission shaft damaged. Flange on cover plate distorted or bent. Pilot bearing worn or frozen to shaft.

SPECIFICATIONS - LONG CLUTCH

Clutch Manufacturer	Long
Type	Dry 2-Plate
Size	15 Inch

Clutch Driven Discs

Number Used	2
Front Driven Disc No. (Stamped)	C-46-413
Rear Driven Disc No. (Stamped)	C-46-414
Thickness (Each disc)	.440 (Ref.)

Drive (Center) Plate

Original Thickness	.892 - .898
Friction Surface Flat Within	.005

Flywheel Plate

Original Thickness	.750"
Friction Surface Flat Within	.005"

Clutch Pressure Plate

Release Lever Pin Hole I.D.	.3285 - .3305
Drive Slot Width	1.750 - 1.752
Friction Surface Flat Within	.005
New Pressure Plate Thickness (Friction Surface to Pin) Refer Figure 5 - 4	1.740 - 1.750

Clutch Pressure Springs

Number Used	24
Free Length (Approx.)	2.843
Lbs. Pressure@2"	122.5

Clearance Between

Drive Blocks and Pressure Plate	.007 - .012
Drive (Center) Plate Lugs and Flywheel Slot	.007 - .012

SPECIFICATIONS - LONG CLUTCH (Cont'd)

Clutch Adjustment

Release Levers to Face of Cover (With New Facings)	1.312 (Ref.)

SPECIFICATIONS - LIPE CLUTCH

Clutch Manufacturer	Lipe-Rollway
Type	Dry 2-Plate
Size	15"

CLUTCH DRIVEN DISCS

Number Used	2
Front Driven Disc No. (At Engine Flywheel)	150-9-1182
Rear Driven Disc No. (At Transmission)	150-9-1183
Facing Thickness	.1875"

DRIVE (CENTER) PLATE

Original Thickness	.898"

FLYWHEEL PLATE

Original Thickness	.750"
Friction Surface Flat Within	.005"

CLUTCH PRESSURE PLATE

Drive Slot Width	1.750+ .002-.000"

CLUTCH PRESSURE SPRINGS

Number Used	18
Colour	Purple
*Lbs. Pressure @ 2.0625"	170

CLUTCH ADJUSTMENT

Release Levers Button to Face of Cover	1.375 (Ref.)

*Height listed is not necessarily the working height when assembled.

Table 1

	PARTS PER MILLION	GRAINS PER GALLON
Chlorides (Maximum)	40	2.5
Sulfates (Maximum)	100	5.8
Total Dissolved Solids (Maximum)	340	20
Total Hardness (Maximum)	170	10

Refer to Table 2 for evaluation of water intended for use in a coolant solution.

Table 2

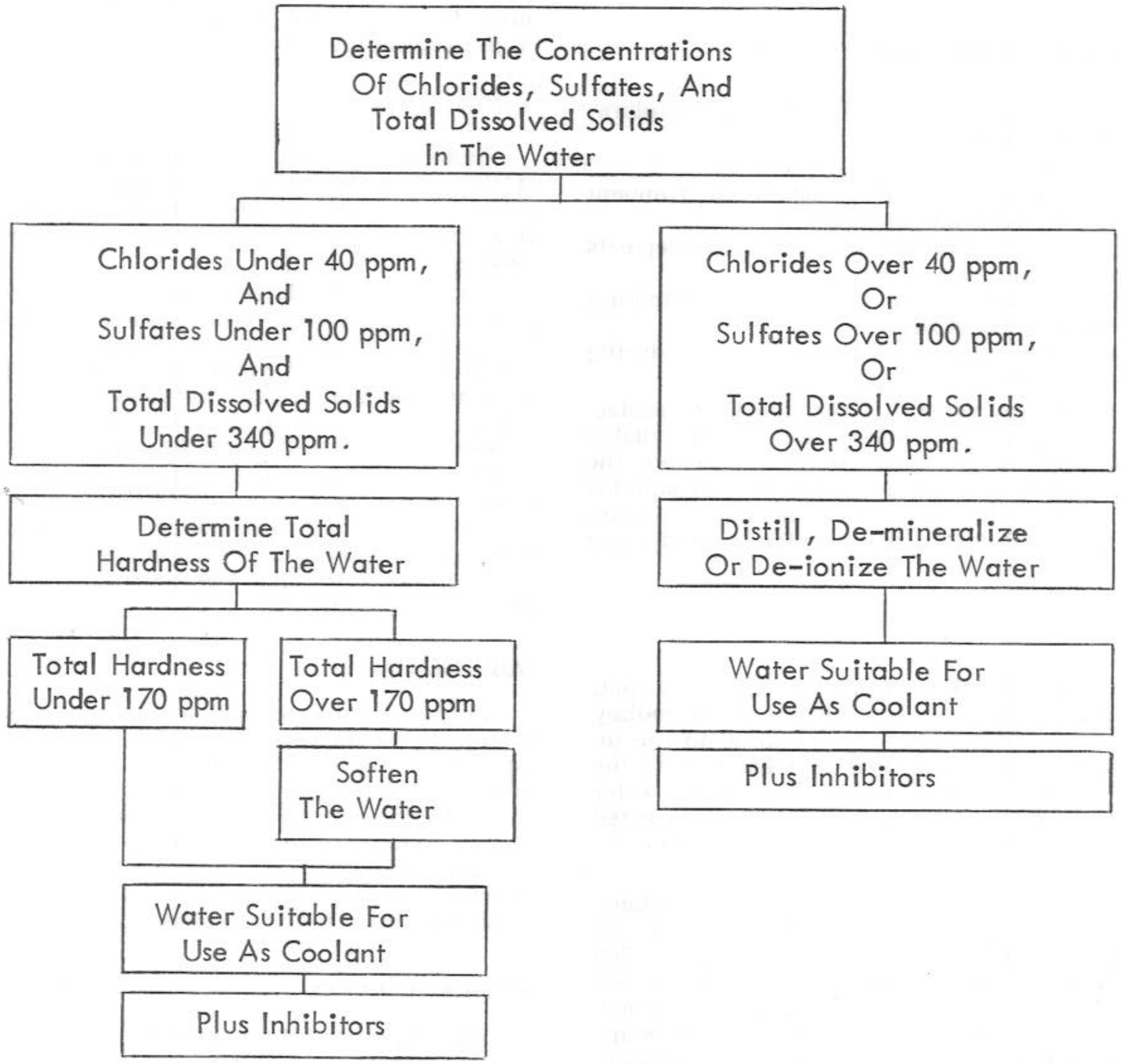

Determine The Concentrations Of Chlorides, Sulfates, And Total Dissolved Solids In The Water
Chlorides Under 40 ppm, And Sulfates Under 100 ppm, And Total Dissolved Solids Under 340 ppm.
Chlorides Over 40 ppm, Or Sulfates Over 100 ppm, Or Total Dissolved Solids Over 340 ppm.
Determine Total Hardness Of The Water
Distill, De-mineralize Or De-ionize The Water
Total Hardness Under 170 ppm
Total Hardness Over 170 ppm
Soften The Water
Water Suitable For Use As Coolant
Plus Inhibitors
Water Suitable For Use As Coolant
Plus Inhibitors

ILLUSTRATION A

rosion protection and water softening ability. Corrosion protection has been discussed earlier under the section of "Corrosion Inhibitors". The water softening ability deters formation of mineral deposits. Inhibitor systems are available in various forms such as coolant filter elements, liquid and dry inhibitor additives and as integral part of permanent antifreeze.

COOLING SYSTEM

DESCRIPTION

Engine coolant is considered as any solution which is circulated through the engine to provide the means for heat transfer from various engine components. In general, water containing various materials in solution is used for this purpose.

The function of the coolant is basic in the design and the successful operation of the engine and must be carefully selected and properly maintained.

COOLANT REQUIREMENTS

A suitable coolant solution must meet the following five basic requirements.

(1) Provide for adequate heat transfer.
(2) Provide a corrosion resistant environment within the cooling system.
(3) Prevent formation of scale or sludge deposits in the cooling system.
(4) Be compatible with the cooling system hose and seal materials.
(5) Provide adequate freeze protecting during cold weather operation.

Normally, requirements 1 through 4 are satisfactory by combining a suitable water with reliable inhibitors. When operating conditions dictate the need for freeze protection, a solution of suitable water and an ethylene glycol type antifreeze containing adequate inhibitors will provide a satisfactory coolant.

WATER

Any water, whether of drinking quality or not, will produce a corrosive environment in the cooling system. Also, scale deposits may form on the internal surfaces of the cooling system due to the mineral content of the water. Therefore, water selected as a coolant must be properly treated with inhibitors to control corrosion and scale deposition.

To determine if a particular water is suitable for use as a coolant when properly inhibited, the following characteristics must be considered. The concentration of (1) chlorides, (2) sulfates, (3) total hardness and (4) dissolved solids. These materials are objectionable for a number of reasons: chlorides and/or sulfates will accelerate corrosion, while hardness (percentage of magnesium and calcium present) will cause deposits of scale. Total dissolved solids may cause scale deposits, sludge deposits, corrosion or a combination of these. Chlorides, sulfates, magnesium and calcium are among but not necessary all the materials which make up dissolved solids. Water within the limits specified on Tables 1 and 2, Illustration A, is satisfactory as an engine coolant when proper inhibitors are added.

CORROSION INHIBITORS

A corrosion inhibitor is a water soluble compound which protects the metallic surfaces of the cooling system against corrosive attack. Some of the more commonly used corrosion inhibitors are chromates, borates, nitrites and soluble oil. Depletion of all types of inhibitors occur through normal operation and therefore, strength levels must be maintained by the addition of inhibitors at prescribed intervals.

CHROMATES

Sodium chromate and potassium dichromate are two of the best and more commonly used water system corrosion inhibitors. Care should be exercised in handling these materials due to their toxic nature.

Chromate inhibitors should not be used in ethylene glycol antifreeze solutions. Chromium hydroxide, commonly called "green slime" can result from the use of chromate inhibitors with permanent type antifreeze. This material deposits on the cooling system passages, reducing the heat transfer rate and will result in engine overheating. Engines which have operated with a chromate inhibitor water must be chemically cleaned before the addition of ethylene glycol type antifreeze. A commercial heavy duty de-scaler should be used in accordance with the manufacturer's recommendation for this purpose.

SOLUBLE OIL

Soluble oil has been used as a corrosion inhibitor for many years. It has, however, required very close attention relative to the concentration level due to adverse affects on heat transfer if the concentration exceeds 1% by volume. For example: 1¼% of soluble oil in the cooling system increases fire deck temperature 6% and a 2½% concentration raises fire deck temperature up to 15%. Soluble oil is not recommended as a corrosion inhibitor.

NON-CHROMATES

Non-chromate inhibitors (borates, nitrates, etc.) provide corrosion protection in the cooling system with the basic advantage that they can be used with either a water and ethylene glycol solution.

INHIBITOR SYSTEMS

An inhibitor system is considered as a combination of chemical compounds which provides cor-

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

COOLANT INHIBITOR CHART

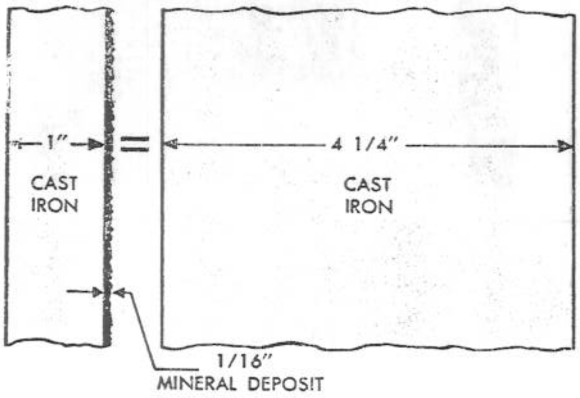
	Inhibitor or Inhibitor System	Corrosion Inhibitor Type	Complete Inhibitor System	Inhibitor Compatibility	
				Water	Ethylene Glycol Solution
	Soldium Chromate	Chromate	No	Yes	No
	Potassium Dichromate	Chromate	No	Yes	No
	Perry Filter Element 5020 (Type O & OS)	Chromate	Yes	Yes	No
	Perry Filter Element 5030 (Type O & OS)	Non-Chromate	Yes	Yes	Yes +
*	Perry Filter Element PAF	Non-Chromate	Yes	No	Yes
	Lenroc Filter	Non-Chromate	Yes	Yes	Yes
**	Nalcool 2000	Non-Chromate	Yes	Yes	Yes

* Discontinued August 1968.
** Available as Nalfleet 9000 for marine applications.

+ Recommended Type

ILLUSTRATION B

HEAT TRANSFER CAPACITY



1" Cast Iron Plus 1/16" Mineral Deposit = 4 1/4" Cast Iron In Heat Transferability

ILLUSTRATION C

The filler cap is located on the right hand side of the coach at the rear above radiator compartment.

Prior to Unit No. 11650, an optional water level sight glass is located near the radiator fill cap on the panel behind the rear-most window on the right side of the coach and is visible from the exterior of the vehicle. The coolant contains a green dye so that level can be easily checked.

Effective Unit No. 11651, a water level check cable is incorporated to check level of water in the surge tank. Pull on cable if no water flows from the drain hose then additional water is required. Also when filling the cooling system, fill water till it overflows from the filler neck. Refer Figure 6-2.

Also effective Unit No. 11651, a vent is incorporated beside the radiator fill cap. This button or vent cock should be depressed before opening filler cap when filling cooling system. Refer Figure 6-1.

1. Vent Cock
2. Radiator Cap
3. Radiator Door

Figure 6 - 1: Radiator Fill Cap

1. Surge Tank
2. Water Level Check Valve
3. Water Level Check Drain Hose
4. Cable - Water Level Check
5. R.H. Blower Housing

Fig. 6 - 2: Water Level Check Valve Location

Two gate valves are located in heater lines to separate the heating system from the engine cooling system. This feature is provided for emergency and maintenance purposes. The driver should make sure these valves are open if the system must be drained in an emergency. One valve is located at the right side of the engine compartment. The other is mounted near the alternator at the left side of the engine compartment.

The cooling system consists of two radiator units, a blower assembly, and the necessary connections and controls. Radiator shutters and blower dampers are automatically operated by air cylinders. Radiator shutters prevent the flow of air through the radiators when it is necessary to maintain the correct engine operating temperature. A thermostat is provided in the engine to prevent the flow of coolant to the engine water passages if engine temperature is below a predetermined minimum. Radiator shutter and blower damper air cylinders are controlled by a shutterstat located on the left hand radiator inlet line.

Cooling air is circulated through the radiator cores by twin centrifugal blowers. Blower wheels are mounted on the output shafts of the blower drive gear box, which is driven by means of a V-belt from the engine crankshaft.

Engine coolant is also used in the coach heating system. The heating system is covered in Section 16 (Heating and Air Conditioning) of this manual.

Under normal conditions, the operation of the cooling system is entirely automatic and requires no operator attention.

DRAINING AND REFILLING COOLING SYSTEM

When the cooling system is drained to protect against freezing, be sure that all drain cocks and plugs have been opened. Drain points are as follows:

HEATER CORE DRAIN COCK: Open right front baggage compartment door and blower plenum chamber door to expose heater core. Open drain cock at base of heater core.

DRIVER'S HEATER DRAIN COCK: Open drain cock located inside and to the left of compartment. This will drain heater core and lines connected to heater core.

CENTRAL HEAT LINES DRAIN PLUG: Accessible through the left hand side service compartment door. Remove drain plug located on feed line above engine mounting.

LEFT HAND RADIATOR RETURN LINE: Remove drain plug from return line located below water pump. This will drain surge tank and left hand radiator and return line.

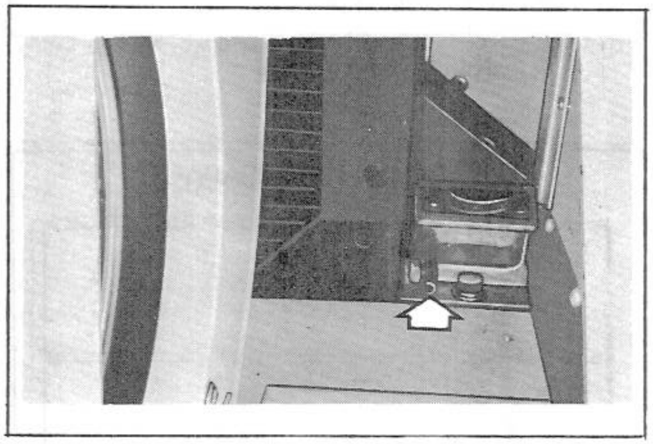
ENGINE OIL COOLER DRAIN PLUG: Remove drain plug located at bottom of cooler housing. This will drain engine oil cooler and partly drain water pump and engine.

SUCTION LINE DRAIN PLUG: Remove drain plug located in right hand side engine compartment to drain the heater core suction line, surge tank, radiators and completely drain water pump.

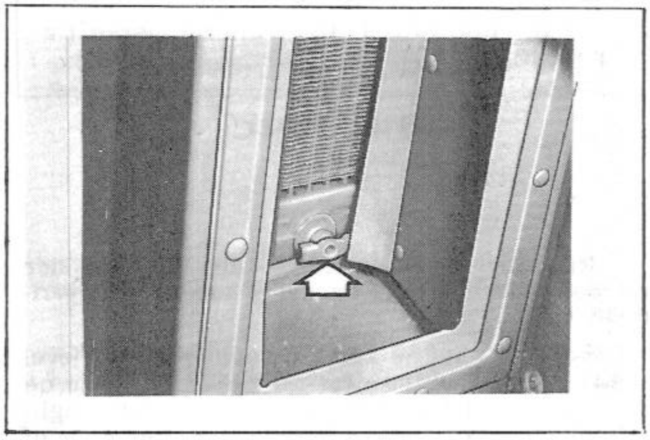
COOLANT FILTER DRAIN PLUG: (If so equipped): Located right rear engine compartment. Remove drain plug at bottom of filter.

AIR COMPRESSOR: Located right side engine compartment. Remove drain plug.

A bleeder valve is located in the driver's heater core and should be opened when the cooling system is being drained.



HEATER CORE
DRAIN COCK

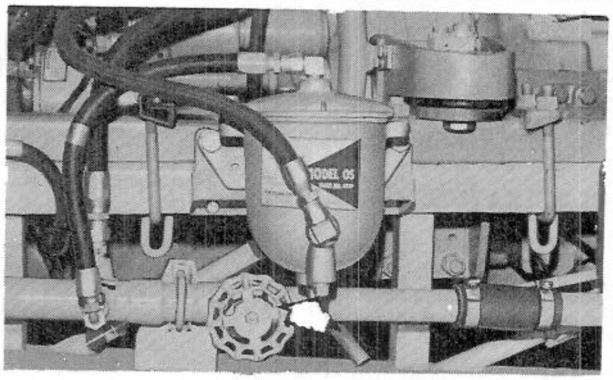


DRIVER'S HEATER
DRAIN COCK

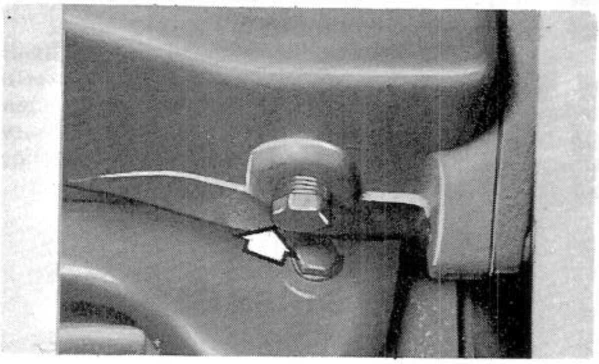
CENTRAL HEAT LINES
DRAIN PLUG

SUCTION LINE
DRAIN PLUG

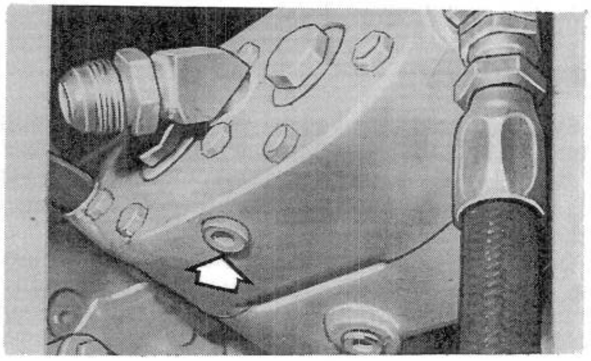
LEFT HAND RADIATOR
RETURN LINE DRAIN PLUGS



COOLANT FILTER
DRAIN PLUG



ENGINE OIL COOLER
DRAIN PLUG



AIR COMPRESSOR
DRAIN PLUG

CAUTION: After draining cooling system attach a suitable tag to the steering wheel indicating that the cooling system is dry.

To fill, close all drain cocks and plugs and fill system with clean water or antifreeze solution until it is approximately half filled (15 U.S. Gallons). Start the engine and continue to fill the system until full.

CAUTION: Cold water should never be poured into the cooling system when the engine is hot as sudden change in temperature may crack cylinder head or block.

When the cooling system is filled to capacity with cold water, expansion of the water takes place when it heats up and it is possible to lose as much as a gallon and a half of water on this initial warm up period. No further excessive water loss should be experienced after this initial loss.

THAWING COOLING SYSTEM

If cooling system becomes frozen solid, place vehicle in warm place until ice is completely thawed out. Under no circumstances should the engine be run when cooling system is frozen.

COLD WEATHER OPERATIONS

Plain water can be safely used as a cooling medium in climates where temperatures do not reach below 32° F. In cold regions, antifreeze must be used.

Before adding anti-freeze solution, cooling system should be inspected and serviced for winter.

Cylinder head gaskets should be tightened or replaced if necessary, to avoid possibility of antifreeze solution leaking into engine and exhaust gases blowing into cooling system.

After anti-freeze solution has been added, entire system should be inspected regularly to ensure against development of leaks.

MAINTENANCE

Systematic periodic inspection of units in cooling system is essential to ensure maximum efficiency.

Check water in radiator surge tank daily. Keep tank filled. Check strength of antifreeze solution if used.

Rust proof cooling system twice a year. Use a good chemically treated antifreeze in the fall and a special rust preventative (inhibitor) with a fresh filling of water in the spring.

Periodically check condition of all hose connections. Tighten clamps if necessary. Replace cracked or swollen hoses. Check belts for proper tension. If belts are frayed, replace. Check radiator cores for leaks. Make certain that core is not clogged with dirt or insects. Clean out with air hose, using low air pressure to prevent damage to fins. Inspect pump operation. A leaky pump sucks in air which increases corrosion.

Repair all leaks promptly. Unchecked leaks can lead to trouble. Inspect and tighten radiator mountings periodically. Test and replace thermostat if necessary. It should be kept in mind, however, that overheating of cooling system may be caused by other than faulty cooling units.

A cooling system filter is available as an optional extra to maintain coolant in a clean condition. If such a filter is used, the element should be replaced at intervals as indicated later in this section.

Commercial cooling system cleaners of either the alkaline or the acid type may be used. Only the highest grade of cleaners should be used, made by reputable manufacturers. Follow manufacturer's directions in all cases.

If problems have developed from leaks and seepage at the engine water pump and thermostat housing hose connections due to deformation and rough surfaces on the castings at the hose mounting surfaces, it is suggested that "DOW CORNING RTV-102 Compound" be applied to the cast surfaces prior to hose installation.

CAUTION: Casting housings should be clean and free of oil and grease before applying compound. Do not use any other sealer with RTV compound.

HOSE CONNECTIONS

Rotten, swollen or worn-out hose, and loose hose connections are frequent sources of cooling trouble.

Serious overheating is often caused by old hoses collapsing or shedding rotten rubber clogs the cooling system.

Old hoses may break without warning and cause loss of solution and overheating. Hardening of old hoses makes it difficult to keep leaktight joints, once connection is broken.

Connections should be inspected periodically and hose clamps tightened. Replace hose if found cracked or swollen. When installing new hose, clean pipe connections and apply a thin layer of nonhardening sealing compound. Replace worn-out hose clamps, or clamps that pinch hose.

COOLANT FILTER (OPTIONAL)

DESCRIPTION

Available as optional equipment is a replaceable—element type coolant filter may be installed in the cooling system. It can be reached for service

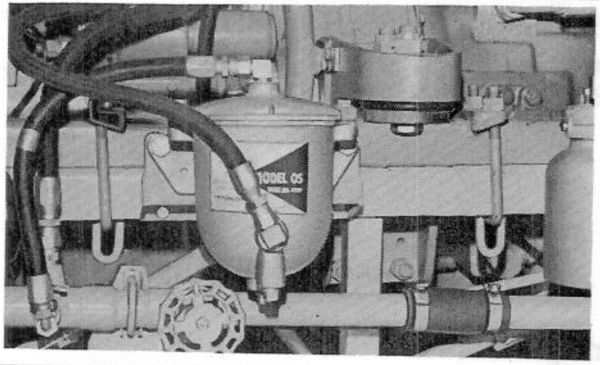


Figure 6 - 3: Perry Water Filter

through the right rear engine compartment door.

The filter element to be used in the cooling system is MCI Part No. 6F-8-25. This element is to be used when ethylene glycol antifreeze or water is used.

To replace element, drain and flush cooling system. Remove the filter cover and clean filter parts. Replace element and reassemble.

NOTE: Whenever a cooling system is changed from one element formula to the other, the system must be drained and flushed.

Replaceable elements are available with various chemical inhibitor systems. Care should be used in the selection of elements relative to inhibitor compatibility with coolant solution as shown in illustration B earlier in this section.

NOTE: Recommended intervals in changing elements is every 500 hours or 20,000 miles.

Problems have developed from the use of magnesium lower support plate used by some manufacturers in their coolant filters. The magnesium plate will be attacked by solutions which will not be detrimental to other metals in the cooling system. The dissolved magnesium will be deposited in the hottest zones of the engine where heat transfer is more critical refer illustration C. The use of aluminum or zinc in preference to magnesium is recommended to eliminate this type of deposit.

High chloride coolants will have a detrimental effect on the water softening capabilities of systems using ion-exchange resins. Accumulations of calcium and magnesium ions removed from the coolant and held captive by the zeolite resin can be released into the coolant by a regenerative process caused by high chloride content solutions.

Commercially packaged, inhibitor systems are available which can be added directly to the engine coolant or to bulk storage tanks containing coolant solution. Both chromate and non-chromate systems are available and care should be taken regarding inhibitor compatibility with other coolant constituents, refer illustration B.

A non-chromate inhibitor system recommended for use in engines. These systems can be used with either water or ethylene glycol antifreeze solutions and provide corrosion protections. One of the approved non-chromate inhibitor systems Nalcool 2000 (Nalfleet 9000 for marine application) offers the additional advantages of a simple on site test to determine protection level and since this product is added directly to the coolant, it requires no additional hardware or plumbing.

SPIN-ON TYPE FILTER

DESCRIPTION

Also available as optional equipment is a spin-on type filter with sacrificial plates can be installed in the cooling system. The spin-on filter can be reached for service through the right rear engine compartment service door.

NOTE: Recommended intervals for changing filter cartridge is every 500 hours or 20,000 miles.

ANTI-FREEZE SOLUTIONS

DESCRIPTION

When freeze protection is required an ethylene glycol base permanent antifreeze should be used. An inhibitor system is included in this type of antifreeze and no additional inhibitors are required on initial fill if a minimum antifreeze concentration of 30% by volume is used. Solutions of less than 30% concentration do not provide sufficient corrosion protection. Concentration over 67% adversely affect freeze protection and heat transfer rates refer to illustration D on following page.

Inhibitor depletion will occur in ethylene glycol base antifreeze through normal service. The inhibitors should be replenished at approximately 500 hours or 20,000 mile intervals with a non-chromate inhibitor system.

Commercially available inhibitor systems such as Nalcool 2000 may be used to reinhibit antifreeze solutions.

Several brands of permanent antifreeze are available with sealer additives. The specific type of sealers vary with the manufacturer. Antifreeze with sealer additives is not recommended for use in engines due to plugging problems throughout various areas of the cooling system.

TESTING ANTI-FREEZE SOLUTIONS

Always test solution before adding water or antifreeze. Engine should warm up to operating temperature. Fill and empty tester several times to warm tester before using. Keep tester clean inside and out.

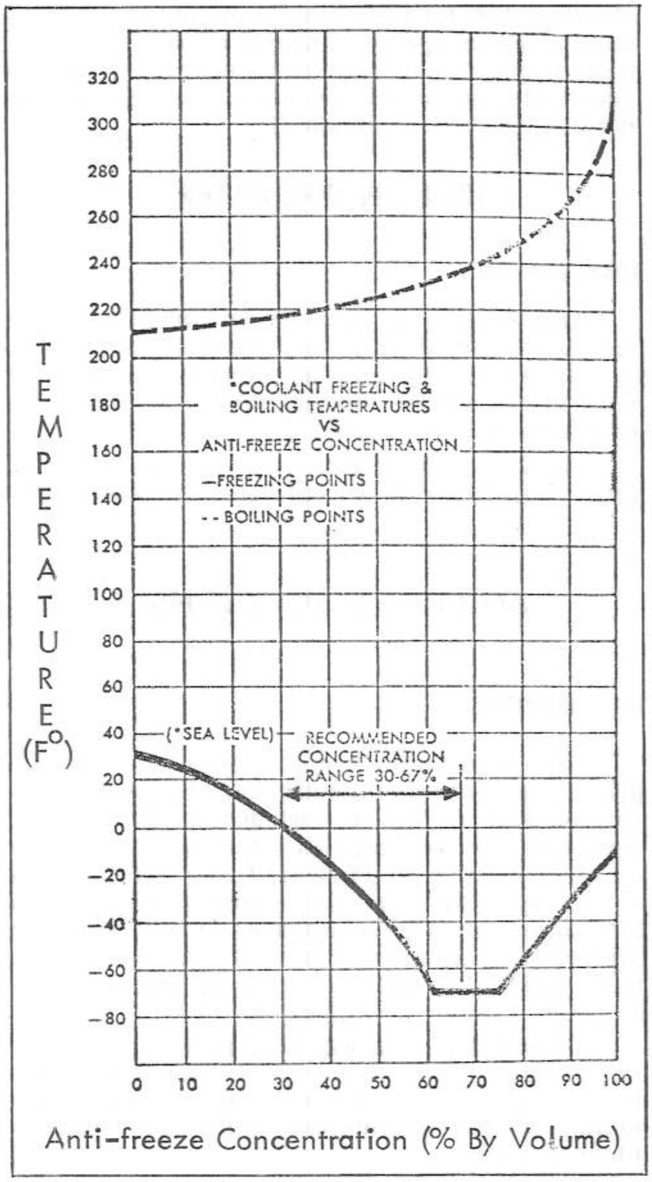


ILLUSTRATION D

COOLING REMOMMENDATIONS

1. Always use a properly inhibited coolant.
2. If freeze protection is required always use a permanent type anti-freeze.
3. Re-inhibit antifreeze with a non-chromate inhibitor system.
4. Always follow the manufacturer's recommendations on inhibitor usage and handling.
5. Do not use soluble oil.
6. Chromate inhibitors should never be used with permanent antifreeze.
7. Sealer type antifreeze should not be used.
8. Maintain prescribed inhibitor strength.

RADIATOR SHUTTERS

DESCRIPTION

Available as optional equipment are two vane-type air operated shutters on the intake side of each radiator core. Each shutter assembly is operated by an air cylinder. The air supply to the shutter cylinders is controlled by a 180 degrees shutterstat in the engine cooling system to assist in maintaining engine temperature.

The radiator shutter and blower dampers work in conjunction with each other. If those assemblies have the air supply closed off, a decided increase in fuel consumption can occur. When coach is operating in lower ambients, the engine temperature does not require them open. Do not shut off air to radiator shutters and dampers.

MAINTENANCE

Radiator shutters should be kept clean and a periodic check should be made to see that they operate freely.

Vane rods and cranks should be lubricated at bearing points regularly at chassis lubrication intervals with a rust preventative oil.

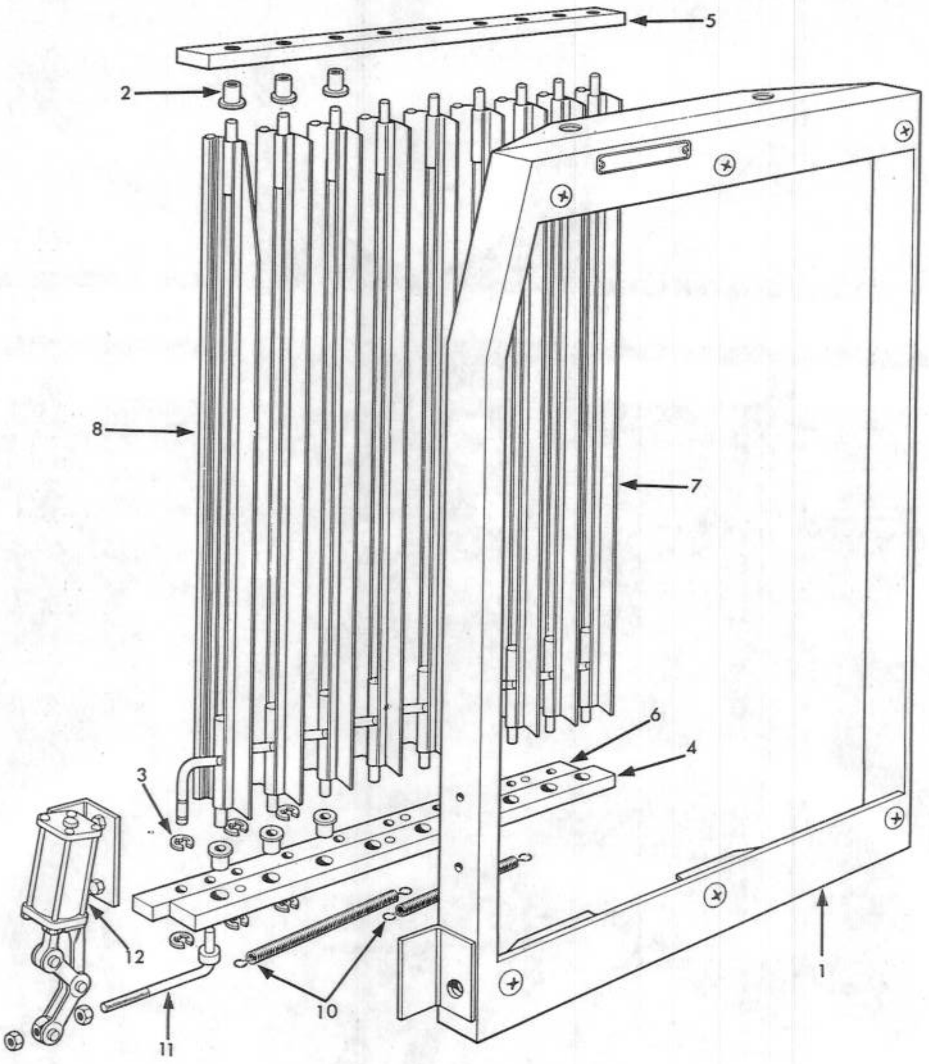
ADJUSTMENT

The operation of shutter air cylinders should be checked periodically and an adjustment made to take up lost motion in the linkage due to wear if necessary. Adjustments should be made with a cold engine and the vanes closed. The vanes should close just enough to provide a tight seal..

Proper adjustment allows the air cylinder piston to be fully extended when vanes seal. Any remaining overtravel on the part of the pistons will result in undue stress on the vane and control bar mechanism. This should be avoided.

REPAIR

Repair of radiator shutter assemblies should not be necessary except after long periods of use unless damage to the parts has occured. Worn or damaged parts should be replaced.



1. Frame Assembly
2. Bushing
3. "E" Retaining Ring
4. Bottom Angle
5. Top Angle
6. Control Bar Assy.
7. Vane Assembly
8. Front Vane Assembly
10. Spring
11. Control Rod Assy.
12. Air Cylinder

Figure 6 - 4: Radiator Shutters

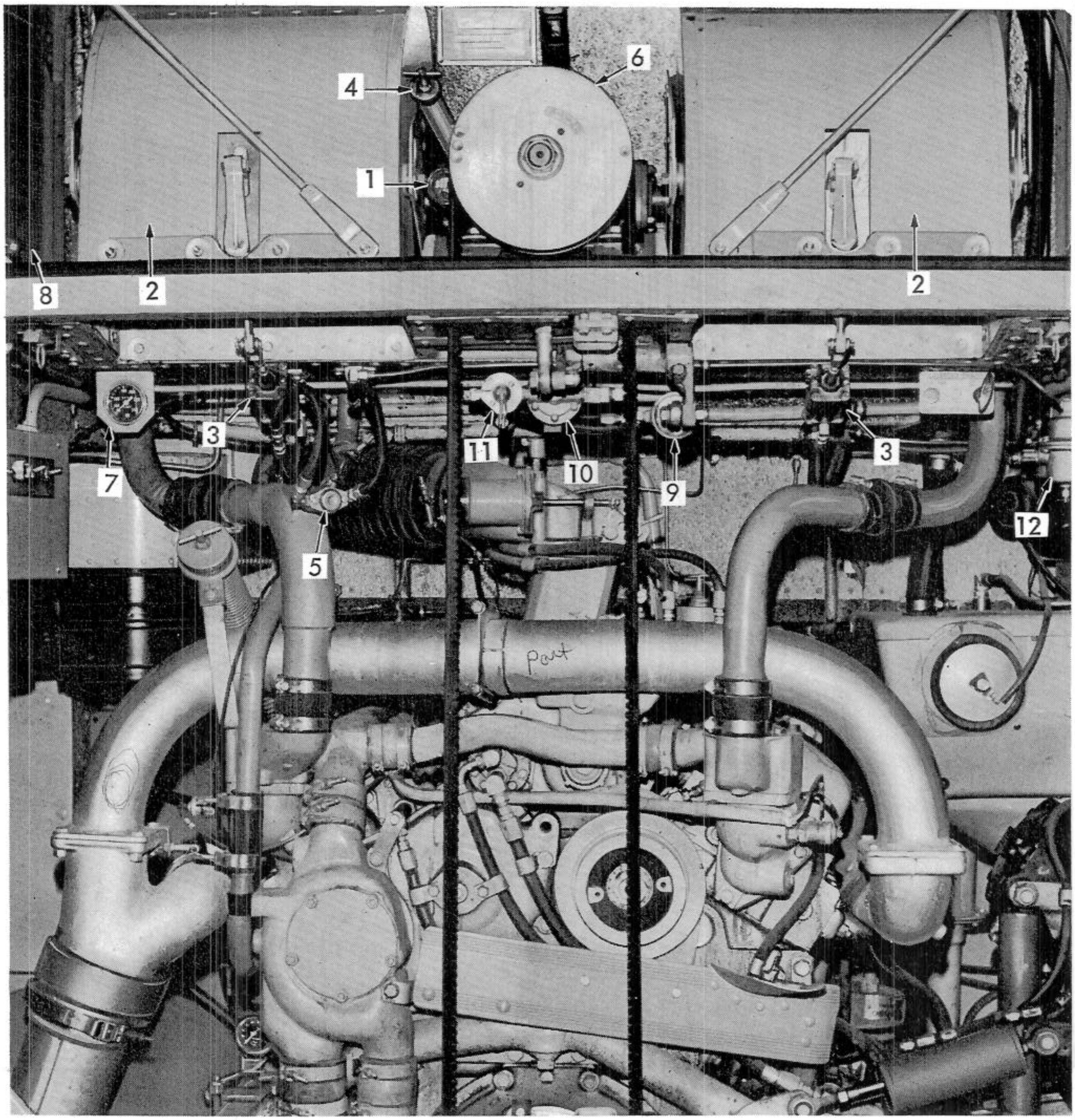
RADIATORS

DESCRIPTION

Two radiators are mounted at the rear corners of the coach at a height which minimizes intake of dust and road dirt.

The radiators are designed to cool the water under all operating conditions; however, the radiator core must be kept free from corrosion and scale at all times in additon to the maintenance of other cooling units to obtain satisfactory service. Cleaning of radiators, inspection of connections and mounting, and use of corrosion preventives are essential periodic service procedures.

Radiator core should be periodically cleaned inside and out in a cleaning solution. Examine core for leaks and bent tubes, and repair if necessary. If the core requires painting, spray with special radiator paint. Do not use paint mixed with oil, as this type will form an insulation on core and prevent dissipation of heat.



1. Gear Box Sight Gauge
2. Blower Scrolls
3. Blower Damper Air Cylinders
4. Gear Box Filler
5. Shutterstat
6. Blower Pulley
7. Water Temp. Gauge
8. L.H. Radiator Assembly
9. Blower Belt Adjusting Air Cylinder
10. Blower Belt Tension Pressure Regulating Valve
11. Control
12. Shutterstat Air Filter

Figure 6 - 5: Rear Engine Compartment

BLOWER DAMPERS

DESCRIPTION

Each blower assembly is provided with an air-operated damper which operates in conjunction with the radiator shutters to prevent the flow of air during engine warm-up. The dampers are located in the outlet ducts of the blowers.

Blower damper linkage adjustment should not be necessary unless the original adjustment is disturbed in disassembly. If an adjustment is to be made the following method should be followed:

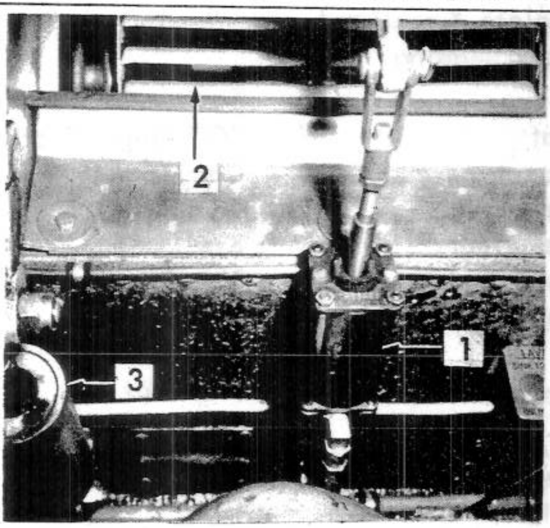
(1) Disconnect the air cylinder at the damper control lever by removing the clevis pin.

(2) Operate the air cylinder so that the ram is fully extended.

(3) Hold the damper in the fully closed position, then adjust the clevis until clevis pin holes line up with clevis pin hole in the damper lever.

(4) Reconnect the air cylinder to the damper control lever by inserting the clevis pin.

(5) Operate the dampers a few times to check opening and closing. If dampers are not closing properly, remove clevis pin and unscrew clevis 1/2 turn, reinstall clevis pin and check closing again, repeat as necessary 1/2 turn per time until dampers are closing with a slight pressure.



1. Blower Damper Air Cylinder
2. Blower Wheel
3. Blower Belt Adjusting Air Cylinder

Figure 6-6: Blower Damper Air Cylinder

Worn linkage parts or air cylinders should be replaced.

Lubricate at pivot points at regular chassis intervals with a rust preventative oil.

BLOWER GEAR BOX

DESCRIPTION

The cooling blowers are located in a housing above the engine compartment. Blower wheels are mounted on a bevel gear box which is driven by means of a V-belt from the engine crankshaft. Air is discharged through openings into the engine compartment.

MAINTENANCE

The blower gear box is lubricated by means of a quantity of lubricant in the gear housing. A sight gauge is provided to check the level of lubricant. Regular service checks should be made to assure that proper oil level is in the cooling blower gear box. The correct oil level is when oil is visible halfway in the sight glass. If the oil is not visible or level does not show when adding oil, the following steps are recommended to provide correct readings:

(A) Remove the oil hose end at vent fitting at top of the blower gear box.

(B) Force air pressure through this end of hose to clear hose, sight gauge and hose from sight gauge to the rear lower part of the blower gear box. This will free hoses from dirt or foreign matter and allow oil to flow to sight gauge providing a level reading.

(C) If the forced air pressure does not flow through as described in paragraph (B), remove the sight glass and gasket. Clean, apply forced air pressure if necessary. Install a new gasket at assembly and replace hoses if damaged or if they cannot be freed from dirt or foreign matter. **Note:** Care should be taken at assembly of sight glass and gasket to prevent any possible obstruction that may plug lines.

The blower gear box should be serviced according to the recommendations contained in Section 10 "Lubrication" of this manual.

Periodic checks should be made of the blower wheels to ensure that they are tight on the shafts. Check and tighten retaining nut if necessary. Blower wheels are dynamically balanced and care should be taken to prevent bending of the blades. Any accumulations of dirt or grease which may cause unbalance should be removed.

CAUTION: Never leave loose objects such as tools, wiper rags, etc. in the blower compartment since these may be sucked into the blower wheels causing excessive vibration and ultimate failure.

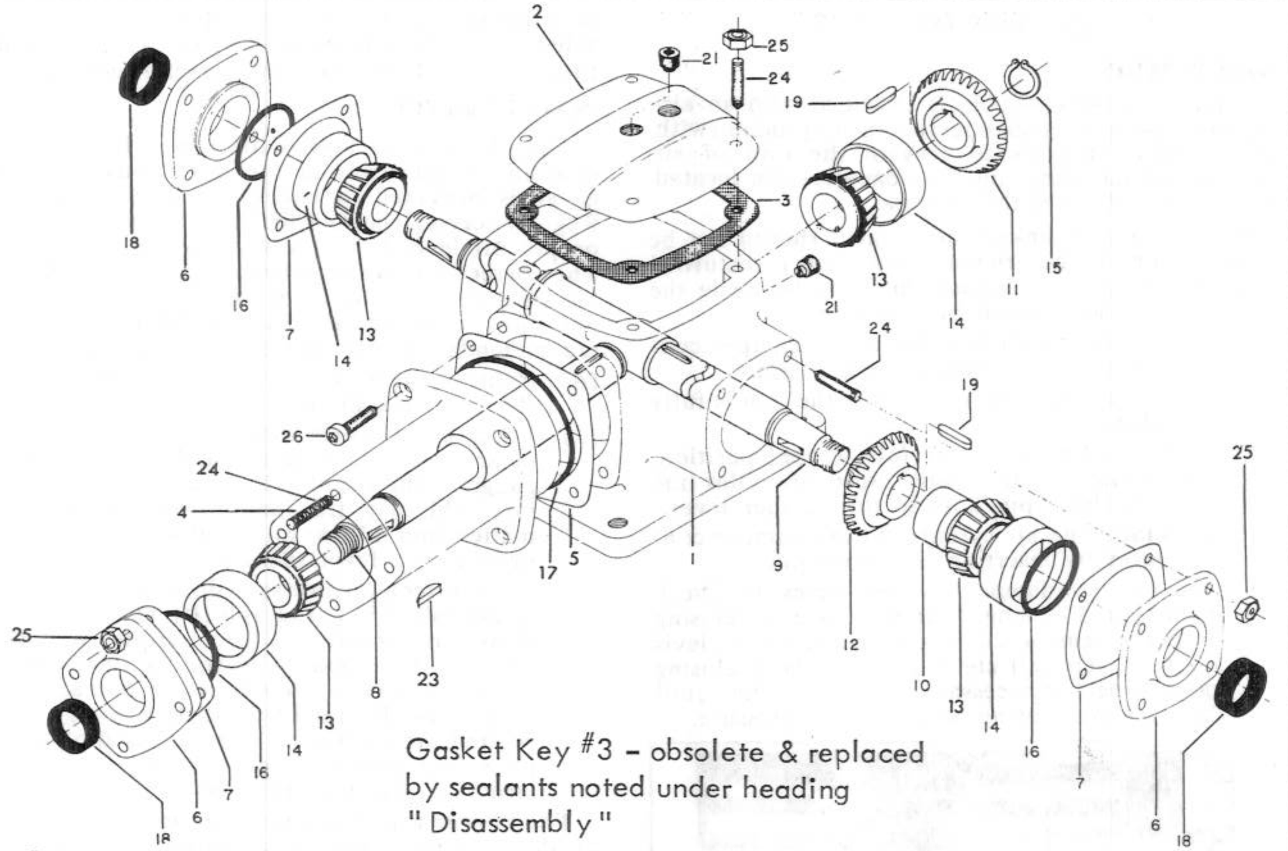
REMOVAL AND REPLACEMENT

The blowers and blower drive gear box may be removed through the blower compartment door. Remove blower drive belt and remove bolts attaching blower housings to blower compartment floor. Remove bolts attaching blower drive gear box. The entire blower assembly can then be lifted out.

In reassembly do not tighten bolts until all mounting bolts are in place and all components have been properly aligned. Clearance between the blower wheel circumference and the blower housing should be 1-1/8". Clearance between the side of the blower wheel and blower inlet venturis should be ¼". The same clearance should be maintained at both sides.

DISASSEMBLY

Remove 4 screws holding down top cover and remove cover and gasket. **Note:** When gasket not available, seal in this area with Permatex Silicone Sealant M.C.I. Part No. 19-16-431 or No. 734 R.T.V. Sealastic Adhesive M.C.I. Part No. 19-16-



Gasket Key #3 - obsolete & replaced by sealants noted under heading "Disassembly"

1.	Housing
2.	Housing Cover
3.	Housing Gasket
4.	Bearing Carrier
5.	Shim - Bearing Carrier
6.	Shaft Cover
7.	Shim - Shaft Cover
8.	Input Shaft
9.	Output Shaft
10.	Output Spacer
11.	Spiral Bevel Pinion
12.	Spiral Bevel Gear
13.	Bearing Cove
14.	Bearing Cup
15.	Snap Ring
16.	"O" Ring - Shaft Cover
17.	"O" Ring - Bearing Carrier
18.	Oil Seal
19.	Key
21.	Pipe Plug
23.	Key
24.	Studs
25.	Stop Nut
26.	Capscrew

Figure 6-7: Blower Gear Box Disassembled

430. This sealant may be purchased from M.C.I. Service Parts Division. Remove screws and input shaft cover. Remove screws and output shaft covers. Remove the cap screws that fasten the bearing carrier to the housing. The bearing carriers, input shaft, bearings and gear will then come out as a unit.

To disassemble input shaft assembly, remove snap ring from inner end at bevel gear. Pull gear from shaft, the bearings and spacer can now be removed from shaft. Using a soft mallet, tap the output shaft out of the housing, the tapered roller bearings and bevel gear will also come out with the shaft. Pull or tap off the bearing cones, slide off the spacers and pull or press off the bevel gear.

Reassembly is the reverse of disassembly.

RAPAIR AND ASSEMBLY

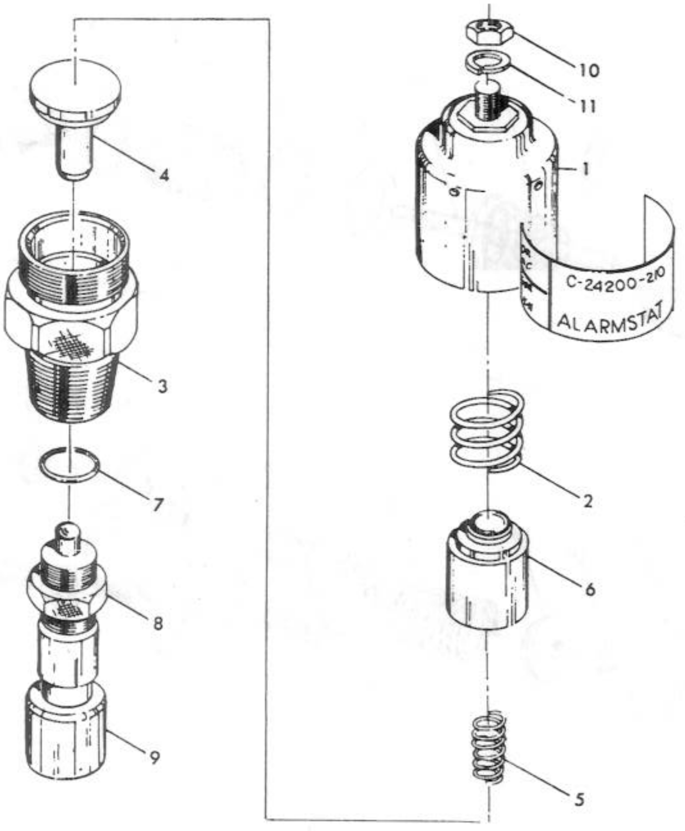
The gears are only supplied in matched honed sets and must be installed so that the timing marks on the back of the gears register.

The back edges of the mitre gears must be flush when installed. This can be accomplished by using the proper number of brass shim gaskets under the output shaft bearing caps.

The tapered roller bearings must be adjusted by means of brass shim washers so that there is no perceptible play or clearance in them..

Backlash of the spiral bevel gears is also controlled by the use of brass shims between the bearing carrier and the main housing .003" to .004" clearance ± .002" is recommended between the gear teeth.

Care must be exercised in installing the shaft seals over the sharp keyways in the shafts. To avoid nicking the inner sealing lip a thin tapered bushing should be made up to facilitate entry of the shaft in the seal and protect the seal while it is being slid over the keyways.



1. Body & Point S/A
2. Spring
3. Base
4. Piston
5. Overtravel Spring
6. Sleeve & Point S/A
7. "O" Ring
8. Nut
9. Power Element
10. Nut
11. Washer

Figure 6 - 8: Alarmstat

ALARMSTAT

DESCRIPTION

This instrument, which controls the warning light and buzzer to indicate engine overheating, is covered under Section 7 (Electrical) of this manual.

SHUTTERSTAT

DESCRIPTION

The shutterstat controls the supply of compressed air to the radiator shutter air cylinders and blower camper air cylinders. The shutterstat is mounted on the left-hand radiator inlet line and can be reached by opening the rear engine compartment service doors.

When engine coolant temperature reaches the 180 degrees to 183 degrees range, the shutterstat cuts off the supply of air to the shutterstat air cylinders, and the radiator shutters open. When engine temperature is below the setting of the shutterstat, air from the coach air system is allowed to enter the shutterstat air cylinders closing the shutters and blower dampers.

MAINTENANCE

Shutterstat air exhaust holes should be kept clear of dirt to prevent back pressure inside adjustment chamber.

At intervals depending upon type of service, remove and clean or replace the screen felts and gasket. Refer to Figure 6 - 5 for shutterstat and air filter unit.

REMOVAL AND REPLACEMENT

To remove shutterstat unit, disconnect air lines and plug or tape holes to prevent entry of dirt. Unscrew and remove shutterstat assembly.

(1) Remove end cap (21), filter (20), spring (19), spring retainer (18), ball (16) and "O" Ring (17).

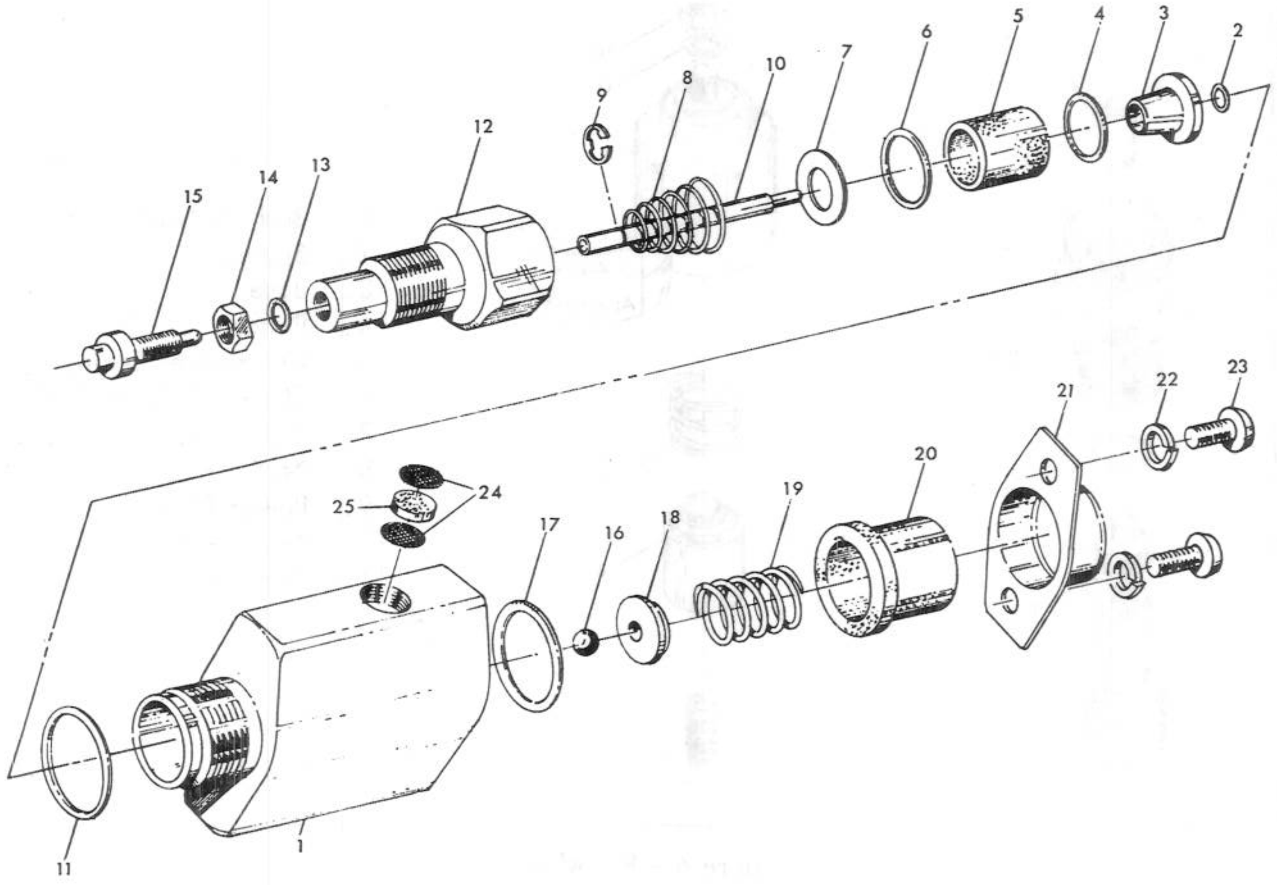
(2) Remove screens (24) and felt (25) from body (pipe thread connection).

(3) Remove power element (15) and "O" Ring (13). Chech position of power element with relation to body for reassembly (approximate setting).

(4) Remove base (12), plunger (10), spring (8), washer (7), seal rings (6, 4, 2, 11), filter (5) and guide (3).

VISUAL INSPECTION AT DISASSEMBLY:

1. Body - Check for damaged threads.
2. Base - Check for damaged threads.



1. Body S/A
2. "O" Ring
3. Plunger - Guide
4. "O" Ring
5. Filter
6. "O" Ring
7. Washer
8. Spring
9. Retaining "E" Ring
10. Plunger Assy.
11. "O" Ring
12. Base
13. "O" Ring
14. Hex. Nut
15. Power Element
16. Ball
17. "O" Ring
18. Retainer Spring
19. Spring
20. Filter
21. End Cap
22. Washer
23. Screw
24. Screen
25. Felt

Figure 6 - 9: Shutterstat

REASSEMBLY

1. Clean all parts in a degreaser solvent (mineral spirits).
2. Reassemble in reverse order of disassembly, Check for foreign matter during reassembly procedure. IMPORTANT: Lubricate "O" rings prior to assembly.
3. When ordering additional power elements, specify your required temperature settings.
4. To seat ball on plunger end, place ball in suitable recess in soft metal and place plunger against ball. Tap opposite end of plunger with a soft metal bar (preferably aluminum).

The shutterstat is adjustable plus or minus three degrees. To adjust, position shutterstat base (12) in vise. Without turning or disturbing power element, loosen locknut (14). To lower temperature setting, turn power element clockwise (into base). One full turn (360°) approximates four degrees. To increase temperature setting, turn power element counterclockwise (out of base). After adjustments, tighten locknut. When more than three degree temperature adjustment is required, replace power element with one of proper temperature setting, or return shutterstat direct to factory.

When replacing shutterstat refer to last three digits on cylinder side of shutterstat for temperature setting.

SHUTTERSTAT AIR FILTER

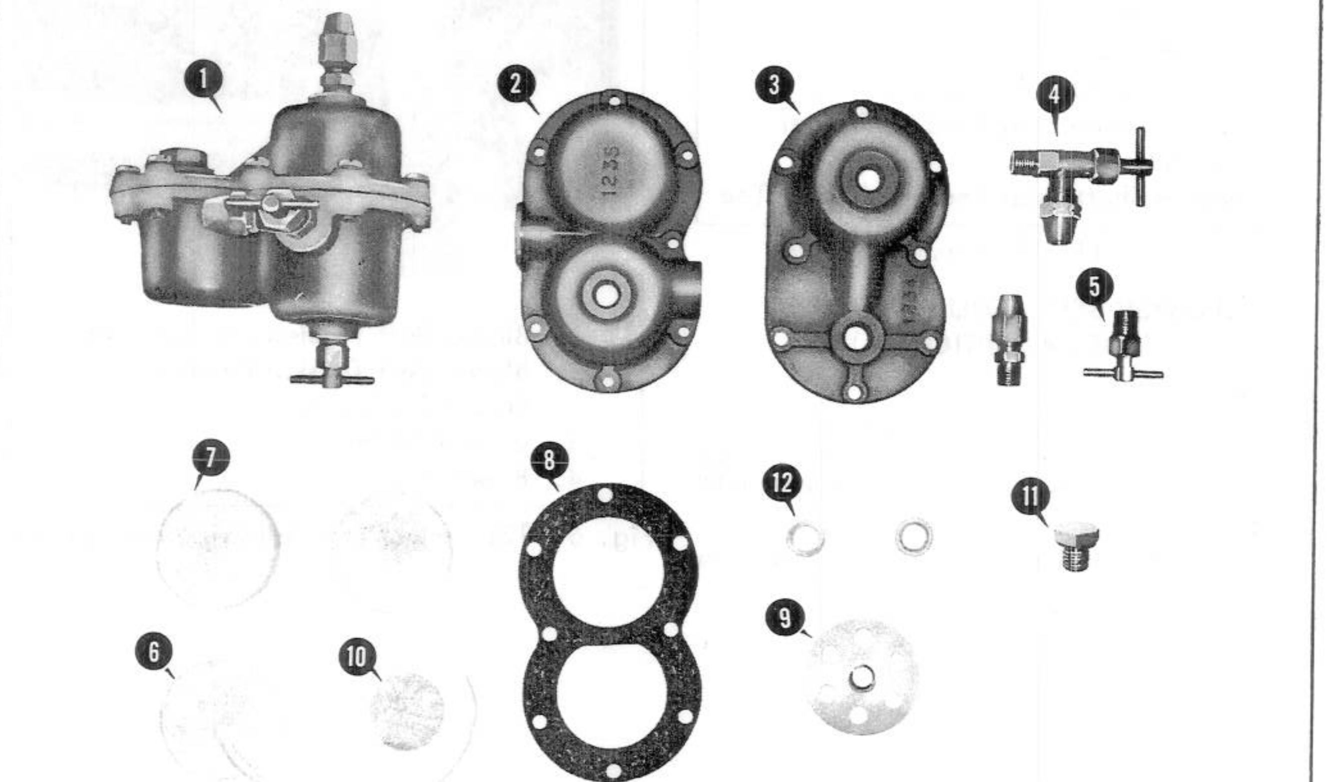
DESCRIPTION

An air filter is installed in the cooling system to prevent moisture from entering the shutterstat and air cylinders. As air from air tank enters filter, it strikes against the baffle which diverts moisture in air stream to bottom of housing. Air then passes through felt filtering element. Air is again filtered through felt before entering thermostatic air valves. Periodic check should be made for leakage at filter connections and tighten if necessary. Air filter fluid chamber holds slightly over one ounce of fluid.

Add about one ounce of No. 10 non-detergent oil to filter every 3000 miles. Large quantities or more frequent filling may overload system.

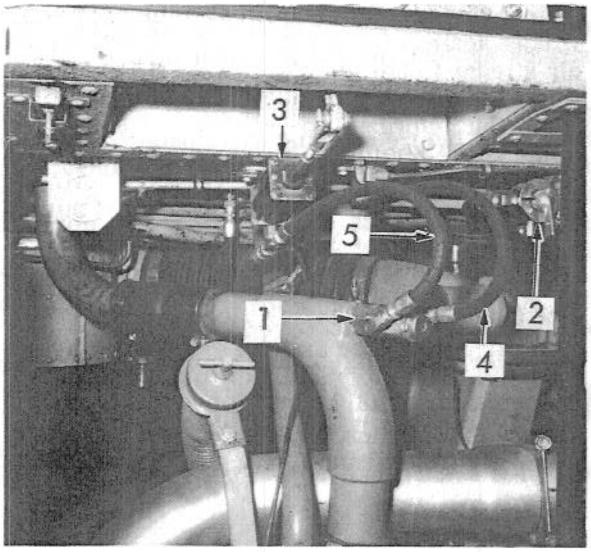
Air filter should be drained every week by opening pet cock at bottom; daily during winter months. This operation should be performed under pressure.

Every 10,000 miles, air filter should be disassembled and the felt cleaned with gasoline or replaced.



1. Shutterstat Air Filter Assy.
2. Body - Bottom
3. Body - Top
4. Cock - 1/4 Stop
5. Cock - Drain
6. Felt - With Oiler
7. Felt
8. Gasket
9. Filter Disc.
10. Screen
11. Filter Plug
12. Gasket - Filter Plug

Figure 6 - 10: Shutterstat Air Filter



1. Shutterstat
2. Control Valve
3. Blower Damper Air Cylinder
4. Hose - Shutterstat Feed to Shutter Air Cylinders
5. Hose - Shutterstat Feed to Anchor Tee

Figure 6 - 11: Shutterstat Installed

BLOWER BELT ADJUSTING AIR CYLINDER (OPTIONAL)

DESCRIPTION

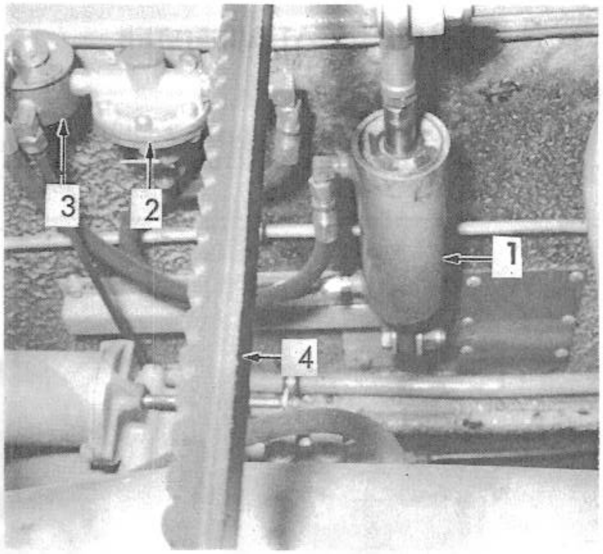
An air-operated blower belt adjusting air cylinder is installed to keep the correct tension of the blower gear box drive belt. Refer to Figure 6-12:

MAINTENANCE

Periodically remove feed hose and add a few drops of oil into the cylinder. When overhauling air cylinder, it is very important to replace all seals, felts, cups and "O" rings with new parts for proper operation. Also when overhauling cylinder the new parts should be coated with oil before assembly.

ADJUSTMENT

The blower belt adjusting air cylinder tension is controlled by a pressure regulating valve. Refer to Section 4 "Brakes & Air System" for correct valve pressure setting.



1. Blower Belt Tension Air Cylinder
2. Blower Belt Tension Pressure Regulating Valve
3. Control Valve
4. Blower Belt

Fig. 6 - 12: Blower Belt Adjusting Air Cylinder

TROUBLESHOOTING

PROBABLE CAUSE	PROBABLE REMEDY
OVERHEATING	
(1) Lack of water	(1) Refill System
(2) Thermostat Sticks Closed	(2) Replace Thermostat
(3) Water Pump Inoperative	(3) Overhaul or Replace Water Pump
(4) Cooling System Clogged	(4) Flush Entire System
(5) Incorrect Ignition Timing	(5) Retime Ignition
(6) Brakes Dragging	(6) Adjust Brakes Properly
(7) Radiator Core Air Passages Clogged	(7) Clean Radiator Core
OVERCOOLING	
(1) Thermostat Remains Open	(1) Replace Thermostat
LOSS OF COOLING LIQUID	
(1) Defective Hose Connections	(1) Tighten or replace clamps at all
(2) Defective Water Pump Seal	(2) Replace Seal
(3) Leaks in Radiator Core	(3) Remove core—Test and Repair Leaks.

SPECIFICATIONS

COOLING SYSTEM CAPACITY	22.8 Imp. Gal. 27.5 U.S. Gal.
THERMOSTAT	
Number Used	2
Start To Open	170°
Fully Open	185°
RADIATORS	
Make	Young
Number Used	2
Type	Fin & Tube
Location	Rear Sides of Coach
BLOWERS	
Gear Box Ratio	1:1
Gears	Spiral Bevel
Bearings	Tapered Rolle
Gear Backlash	.003" - .004"
Backlash Adjustment	Shims
Number Fan Blades	36
Diameter	10½"
Rotation	L.H.-C.W.R.H.C.C.W.
Blower to Housing Clearance	1/4"
Blower Circumference to Housing Clearance	1-1/8"
SHUTTERSTAT	
Make	Kysor
Model	D-24000
Temp. Range	180° - 183°
Shutterstat Needle Travel	.0045" - .005"

SPECIFICATIONS (Cont'd)

ALARMSTAT	
Make	Kysor
Number	C-24200
Points Set to Close At	210° F.
TEMPERATURE GAUGE	
Make	AC
Number	6400952
Operating Range	100° - 250°
Voltage	24V
BLOWER BELT ADJUSTING AIR CYLINDER	
Spring Free Travel	6.25"
Spring Load At 4.00"	180 lbs. ± 10%
Spring Rate Per Inch	80 lbs. ± 10%
Piston O.D.	
Max. Dia.	1.993"
Min. Dia.	1.992"
Cylinder I.D.	
Max. Dia.	2.000"
Min. Dia.	1.996"
BLOWER DAMPER AIR CYLINDER	
Cylinder I.D.	1.750"
1-3/8" Travel—From Center of Mtg Hole to Closed Piston Rod End	8-1/8" ± 1/16"
SHUTTER AIR CYLINDER	
Cylinder I.D.	1.750"

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

ELECTRICAL SYSTEM

DESCRIPTION

The coach uses a 24-volt electrical system. A 24-volt self-rectified alternator is belt-driven from the engine and can be reached through the left rear engine compartment door.

BATTERY DISCONNECT

A main battery disconnect switch is provided to shut off all electrical supply from the batteries. The switch is located at the right front corner of the baggage compartment and can be reached through the right front baggage compartment door. To disconnect batteries, pull knob down to "OFF" position.

WIRING DIAGRAMS

At the end of this section are included wiring diagrams for various circuits of electrical system. Diagrams provided and components in each are as follows:

CHARGING SYSTEM: Includes charging circuit, showing generator, regulator, batteries, discharge relays and tell-tales, field relays, and starter connection.

LIGHTING SYSTEM: Shows interior and exterior lights, relays and switches and turn signal light and switches.

MOTOR CONTROL SYSTEM: Shows wiring for engine starting circuit, engine shut-off system, reverse shift circuit, etc.

ALARM & TELL-TALE SYSTEM: Shows wiring for overheating, low oil, low air, and fire alarm warning systems, passenger chime, lavatory alarm, etc.

HEATING & AIR-CONDITIONING: Includes wiring for heating and air-conditioning motors, valves and controls, etc.

P.A. SYSTEM: Shows wiring for Public Address System. (If used).

INSTRUMENT WIRING SYSTEM: Shows wiring of oil, temperature and fuel gauges, also shows water, oil pressure and fuel sending units.

TEMP-N-LEVEL CONTROLS SYSTEM: Shows wiring on oil level, Hot Engine and surge tank relays, also shows Surge tank, Hot Engine oil level and low fuel level sensors. Also shows water level, low oil, Hot Water telltales, engine stop relay and 3 lb. oil switch.

BAGGAGE COMPARTMENT IN-STATION LIGHTENING: Shows baggage compartment lightening connections, circuit breakers and fuses.

IN-STATION HEATERS: Shows wiring of lavatory tank, engine block, oil pan immersion heaters connections, control thermostat and ambient control switch.

TESTING CIRCUITS

A careful study of the wiring diagrams should be made to determine the source and flow of current through each electrical circuit. When a circuit is thoroughly understood, a point to point check can be made with the aid of the applicable wiring diagram, to determine location of trouble. Any circuit can be tested for continuity or short circuits with a 2-candlepower test light or voltmeter.

All electrical connections must be kept clean and tight. Loose or corroded connections will cause discharged battery, difficult starting, dim lights, and improper functioning of other electrical circuits. Inspect all wiring connections at regular intervals. Make sure knurled nuts on all amphenol plugs are securely tightened.

CIRCUIT BREAKERS

All electrical circuits are protected by circuit breakers. The main circuit breaker and two main circuit breakers protecting the air conditioning system blower motors are located at the front of the baggage compartment and can be reached through the left front baggage door.

The main circuit breaker (105A) is an automatic reset type. The condenser motor (105A) and evaporator motor (60A) must be manually reset.

Smaller circuit breakers of the self-resetting type are located in the junction panel to the operator's compartment. When one of these circuit breakers opens due to a shorted circuit, it will automatically reset itself when the breaker element cools. As long as the short exists, the breaker will continue to open and close intermittently. In this case turn the defective circuit off, if possible, until the cause can be located and corrected.

RELAYS

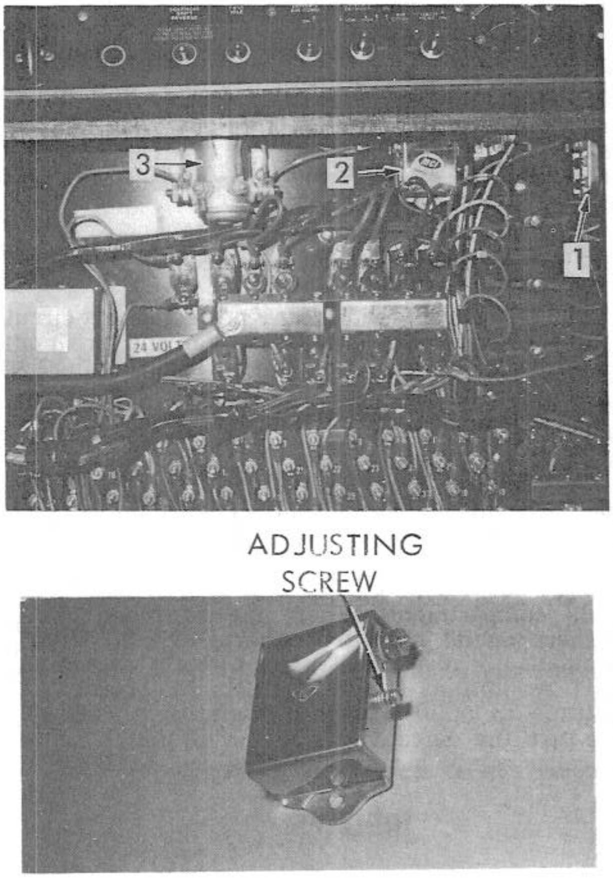
Relays are used in some instances to automatically open or close a circuit as operating conditions may require; in other cases they are used to provide a direct connection between the battery and an electrically operated device, with only a small amount of current required to energize the relay operating coil flowing through the controlling switch. The latter use eliminates the use of great lengths of heavy wire, thereby providing higher voltage to the electrical device. Listed below are locations used: Low and high note horn, headlight, flush-type lavatory, discharge & blower cut-in, Engine Stop, Stop Light, Turn Light, Reverse Solenoid, Starter Solenoid, Condenser and Evaporator Motor, Temp. & Level Sensors and Heat Control Box.

NOTE: The relays for the reverse and starter solenoid, condenser and evaporator motor and horn, it should be noted that the 5/16" stud nuts torque is 50± 10 inch lbs.

ALARM BUZZERS

DESCRIPTION

The alarm buzzers for the alarm system are mounted in the front junction box to the left of the driver. The alarm buzzers for the alarm system are Hot Engine, Low Oil, Low Air, Fire Detector, Lavatory and Air Conditioning. The alarm buzzers may be adjusted for increased or decreased alarm sounds. To adjust buzzers for desired sound, remove the front junction box cover and open public address system door.



1. Alarm Buzzer
2. Air Conditioning Buzzer
3. Horn Relay (Effective Unit No. 11901)

Figure 7-1: Buzzer Location & Sound Adjustment

NOTE: Activate each circuit during adjusting buzzer for desired sound. To increase sound, turn adjusting screw clockwise; counter-clockwise to decrease. Refer to Figure 7-1A for adjusting screw.

The manufacturers specified range is between 65 and 75 decibels. The factory set range is 75 decibels.

HEADLIGHTS

DESCRIPTION

Headlights are double filament "Sealed Beam" type and are mounted in the front of the vehicle.

Switch marked "Headlights" mounted in the driver's switch panel to the left of the driver controls headlights. High or low headlight beam is selected by means of a floor-mounted dimmer switch. When high beams are on, a tell-tale light marked "Hi Beam" on the instrument panel will glow.

MAINTENANCE

Clean with water and a good glass cleaner whenever dirty.

For maximum illumination head lamps must not be blackened and proper voltage must be maintained. Low battery, loose or dirty electrical contacts in wiring system and poor ground all contribute to a decrease in voltage. Check wiring and connections regularly and keep battery properly charged. When headlamp burns out, a complete new sealed beam unit must be installed.

REMOVAL

Remove bezel retaining screws and remove bezel. Remove three screws which hold sealed beam unit in housing. Pull unit out of housing. Disconnect plug-in socket. Install new sealed beam unit reversing above procedure.

HEADLIGHT ADJUSTMENT

Headlights must be aimed carefully and accurately to assure safe vehicle operation at night. Adjustments can be made quickly and accurately with a headlight tester. However, if equipment is not available, make adjustments as described below.

(A) Place vehicle on level floor so headlights are 25 feet from a smooth vertical surface preferably of light color. A door or wall is suitable. Center line of vehicle should be perpendicular to this vertical surface.

(B) Draw a horizontal line on vertical surface at height of light center. Locate point on this horizontal line at which projected centerline of vehicle intersects. Measure distance between lamp centers and divide this distance equally on either side of center mark. Then draw two vertical lines directly ahead of each light center.

(C) Switch on high beam and cover one light adjusting other.

(D) Remove light bezel retaining screws and aim light beam with adjusting screws. Top screw provides horizontal adjustment.

(E) When aiming headlights, beam may appear distorted. A new sealed beam unit must be installed to correct this condition.

(F) After headlight is properly aligned, cover its beam and proceed in same manner as above with opposite light.

GENERATOR

DESCRIPTON

The 24-volt generator, is a fan cooled, diode rectified, brushless unit in which current-carrying conductors are stationary. The only movable part is the rotor, which is mounted on two ball bearings located in the drive and frame. Rubbing seals are provided to retain grease in the bearing reservoir. The generator should be checked externally for grease leakage at the drive end about every 100,000 miles after 300,000 miles have been accumulated.

The current-carrying conductors in the generator are the field winding, the stator windings and six diodes. The field winding assembly is attached to the end frame by four attaching bolts. The stator windings are assembled inside the laminations and stator frame, and are connected electrically to the six diodes which together comprise the rectifier. The D.C. output terminal on the generator end frame is connected to the rectifiers.

The main functional parts of a generator are the stator (which compares functionally with the D.C. generator's armature); the rotor (which functions as the field coils and pole pieces); and the rectifier (which performs the same duty as the commutator and brushes).

The rotor produces the lines of force. As these lines of force cut the stator windings, a three-phase A.C. voltage is generated. This voltage is conducted to the rectifier unit, which electrically changes the A.C. to usable D.C.

The stator of the generator is stationary, so the winding is not subject to centrifugal force. More windings can be inserted in the stator slots to give a greater electrical output than from a D.C. generator of equal size.

The high output current is taken directly from the stator, so it is not necessary to use large brushes or a slotted commutator that might cause sparks or be subject to mechanical wear.

The rectifier unit changes the output of the generator to D.C. electrically.

A relay terminal which is a ¼" N.F. stud at the pulley end of the alternator, is used to energize a control relay in the electrical system.

CAUTION: This model generator is designed for use with a negative ground system only. If a positively grounded battery is connected to this negative ground generator, the generator and wiring will be instantly damaged. Always make sure the battery and generator polarities are matched before making connections. Also, do not ground or short across any of the generator or regulator terminals.

INSPECTION

It is recommended that the generator be inspected at regular intervals and any accumulation of dirt removed. The generator should be removed from the coach every 80,000-100,000 miles and accumulation of foreign matter checked by removing the field end. If dust accumulation is excessive, disassemble the generator. The inner bearing will require replacement as the axial stress caused by removal will, in most cases, damage the bearing.

The condition of the outer bearing and the lubricant in the grease pocket should be checked. The outer bearing should be removed before cleaning to ensure that no solvents enter the bearing.

The entire generator should be thoroughly cleaned using white gasoline or similar non-oily solvents. DO NOT STEAM CLEAN.

Reassemble the generator using the procedure outlined under (Bearing Replacement and Lubrication).

If the generator is relatively clean, the inspection periods may be extended.

Before checking the generator, move battery disconnect switch to "OFF" position.

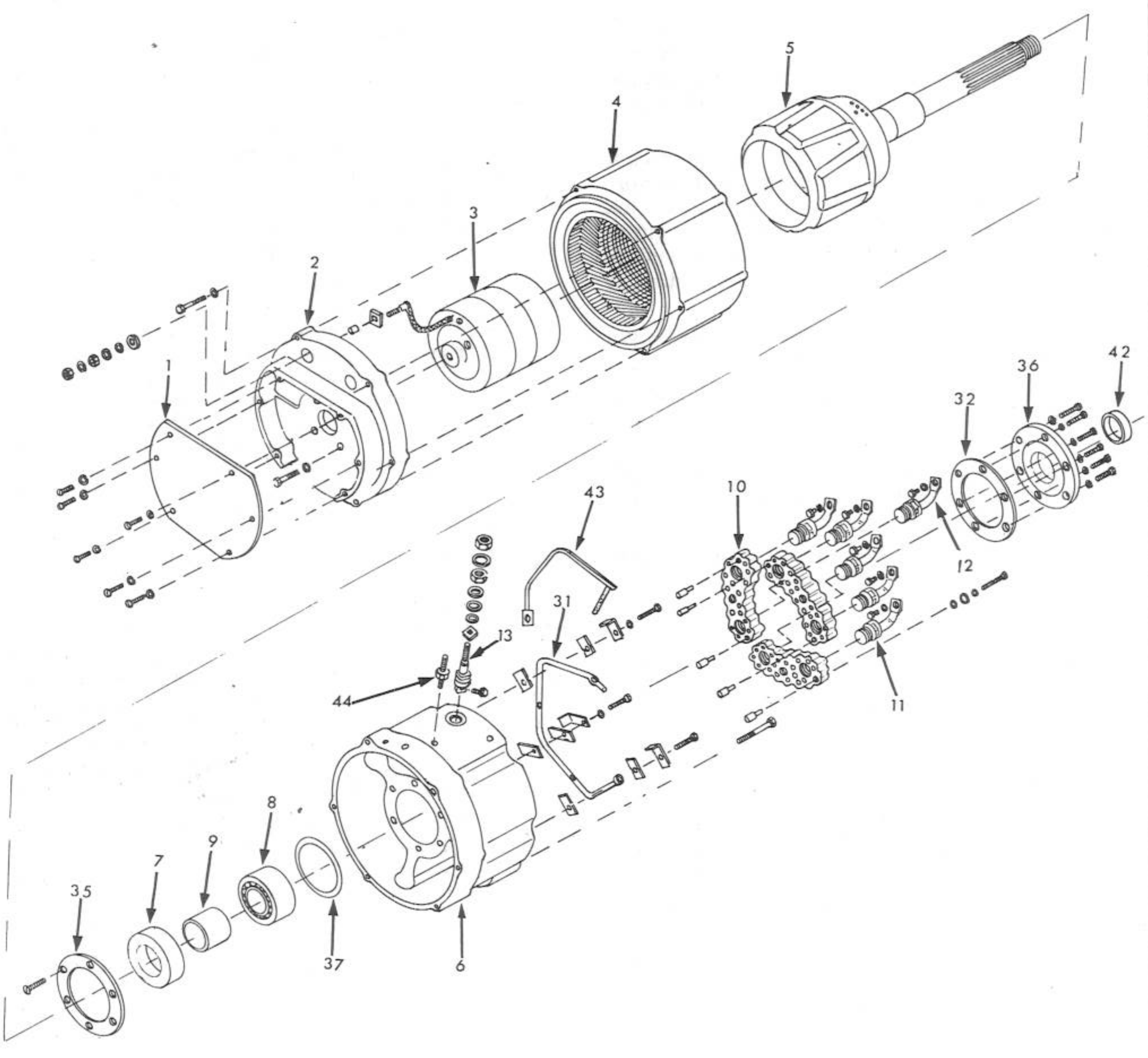
Since two different diodes are used in this generator, care should be taken to ensure that the diodes are properly located in each heat sink.

NOTE: Torque main shaft nut to 210-220 ft. lbs.

OUTPUT CHECK

To check the generator for output, make connections as illustrated in Figure 7-2, operate at specified speed, and check for rated output as given below. Adjust the load rheostat, or turn on vehicle accessories, if necessary to obtain the rated output.

CAUTION Since this is a negative ground generator, make sure to connect the negative battery



1. Cover Plate - End Frame
2. End Frame
3. Field Assy.
4. Stator Assy.
5. Rotor Assy.
6. D.E. Frame
7. Inner Ball Bearing
8. Outer Ball Bearing
9. Spacer
10. Heat Sink
11. Diode - Silicon Neg.
12. Diode - Silicon Pos.
13. Terminal Stud Assy.
31. Buss Bar
35. Retainer - Ball Bearing (Inner)
36. Retainer & Seal - Outer
37. Seal - "O" Ring - Rotor Shaft
42. Spacer - Shaft Outer
43. Terminal & Clip Assy.
44. Ground Terminal

Figure 7 - 1A: 24-Volt Generator Assy.

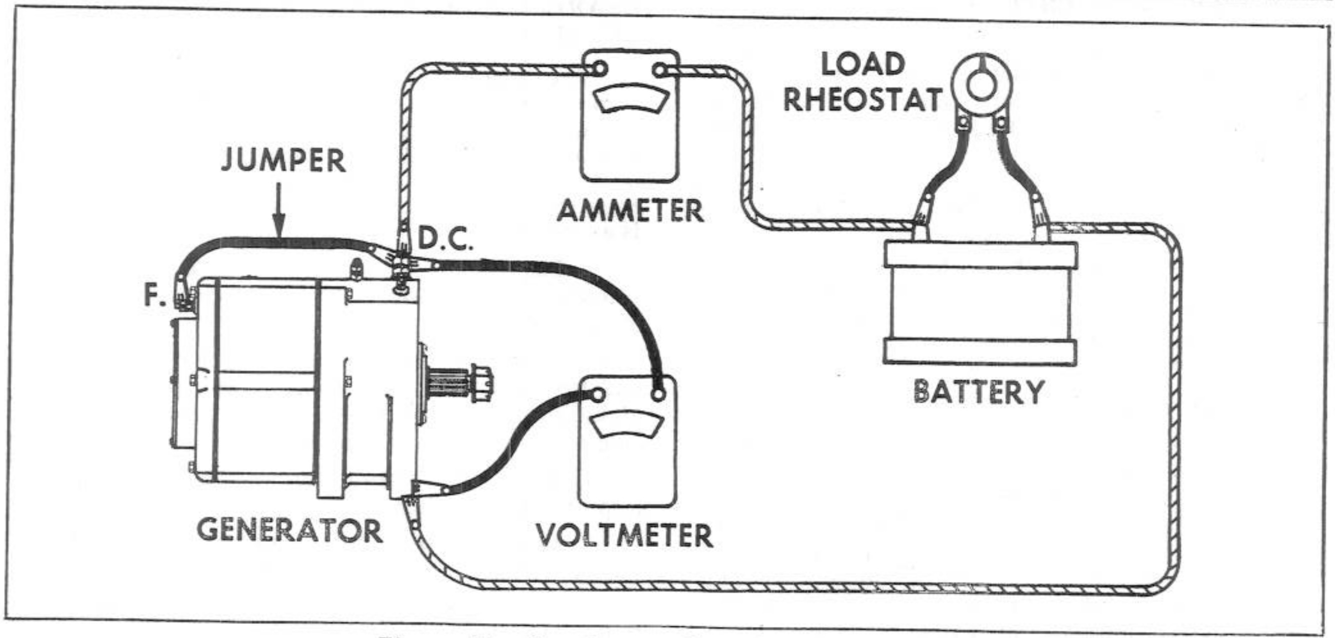


Figure 7 - 2: Connections for Output Check

post to the generator frame.

If the generator fails to perform according to specifications, the field winding, the six diodes and the stator winding should be checked. These components can be checked with the generator mounted on the engine, after the fan and pulley are removed to expose the diodes lead stud attaching nuts. Before checking the generator, disconnect the battery by turning the battery disconnect switch to "Off".

Specified cold output (27½ Volts) at maximum engine governed speed is 225 Amps.

FIELD WINDING

The field winding may be checked for shorts, grounds, and opens with an ohmmeter.

To check the field winding, disconnect the lead from the field terminal and connect an ohmmeter from the field terminal to ground and note the reading. The normal resistance value is 3.9 to 4.2 ohms at 80 °F. For most accurate results the ohmmeter should be one on which the normal resistance value will be at or near mid-scale. A resistance reading above normal indicate an open, and a resistance reading less than normal indicates a short or ground. An alternate method of checking is to connect a battery of specified voltage and an ammeter in series with the field winding. The current reading should be 5.7 to 6.2 amperes at 24 volts. A defective field can be replaced by removing the end frame on which the field terminal is located, and then removing the four field coil attaching screws.

CHECKING DIODES

To check the generator diodes, first detach the three diode leads from the bus bar, and the other three diode leads from the frame. Using an ohmmeter that has a scale on which the 300 ohm value is within, or nearly within, the middle third of the scale, connect one ohmmeter lead to the heat sink in which the diodes are mounted and the other ohmmeter lead to a diode lead. Note the reading. Then reverse the ohmmeter lead connections and note the reading. The diode is defective if both readings are less than 300 ohms, or if both readings are greater than 300 ohms. A good diode will give one very low and one very high reading.

CAUTION Do not use high voltage, such as 110 volt test lamp, to test diodes.

DIODE REPLACEMENT

Since two different diodes are used in this generator, care should be taken to insure that the diodes are properly located in each heat sink.

Since this is a negative ground generator, the three diodes whose leads are connected to the frame have an arrow on the case pointing towards the heat sink. The other three diodes whose leads are connected to the bus bar have an arrow on the case pointing towards the bus bar.

To replace a diode, proceed as follows:

1. Remove the heat sink by detaching the two heat sink screws and the nut on the stator lead stud.
2. Secure the heat sink in a vise, and remove the defective diode. To facilitate removal, the assembly may be immersed briefly in hot water just below the boiling point.
3. Apply a light film of grease to the threads of the new diode, and torque to 15-17 lb.ft.
4. Assemble the heat sink to the end frame, and attach the nut to the stator lead nut. Note the stack-up of parts on the two screws which insulate the heat sinks from the frame.

STATOR WINDING CHECKS

With all six diode leads disconnected as covered in the proceding section, connect an ohmmeter lead to each pair of heat sinks and note the reading. If any reading is high, the windings have excessive resistance or are open.

Also connect the ohmmeter from any heat sink to the frame. If the reading is low, the stator windings are grounded.

It is not practical to check the stator windings for shorts due to the very low resistance of the windings. However, if all other checks are satisfactory, but the generator fails to provide rated output, shorted stator windings are indicated.

REMOVAL AND INSTALLATION

(1) Before attempting removal, turn main battery disconnect switch to "off" position.

(2) Locate the 4 wires connecting to the generator and identify them with a tag or any other such manner, so that they are returned to the same studs on the replacement generator. The terminals are output terminal (the largest terminal), the relay terminal (the smallest) and the ground. These are located near the fan end of the generator. The 4th terminal is a field terminal on the back of the generator.

(3) Relieve tension on the generator drive belts by turning knob on the control valve one-quarter turn. Disconnect the self adjusting link at the generator end by unscrewing the two screws that connect the casting to the generator. The screws should be identified in some manner and returned to the same tapped hole from which they came. Using the wrong screws can cause internal damage to the generator.

(4) At this stage, the generator is supported by the drive belts only. Remove two of the four base screws that are visible in this position.

(5) Tip up the generator towards the engine and slip off the belt at the generator pulley. Carefully swing the generator down to expose the remaining two base screws.

(6) Remove the two remaining screws and lift out generator.

(7) To replace the generator, follow the above steps in reverse. Turn the main battery disconnect switch to the "On" position.

(8) Check for normal operation of generator and set up to required voltage (approx. 27½ volts).

DISASSEMBLY

The generator can be disassembled by following the steps outlined below.

1. Remove the pulley and fan.
2. Separate the end frame opposite the drive end from the main frame.
3. Detach the three nuts which secure the three stator lead studs to the three heat sinks.
4. Carefully press the rotor from the end frame.
5. Remove the bolts, and separate the drive from the stator and frame assembly.

BEARING REPLACEMENT AND LUBRICATION

The bearings are a press fit into the drive end frame and can be removed after detaching the retainer plates. If there is any doubt as to the condition of a bearing, it should be discarded and a new one used. With both bearings and the spacer removed from the end frame, the proper method of reassembly is as follows:

1. Each bearing should be filled one-quarter full with Delco #1948 791 or Chevron BRB-2 lubricant.

2. Assemble the single row bearing into the end frame by pressing against the outer race only. Make sure the sealed side of the bearing is on the side away from the grease reservoir.

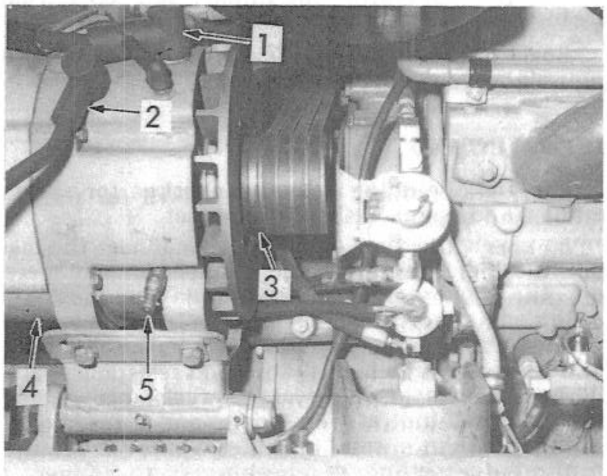
3. Attach the retainer plate and stake the screws to prevent loosening.

4. Assemble the stator frame and attach the nuts to the stator studs on the heat sinks.

5. Fill the grease reservoir only one-half with Delco #1948791 or Chevron BRB-2 lubricant. Insert the spacer.

6. To avoid pressure on the bronze ring in the rotor, support the inside of the motor against the shaft, and place the shaft in an upright position.

7. Press against the spacer to force the single row bearing inner race into position over the shaft.



1. Harness - Battery Feed
2. Harness - Generator Ground
3. Pulley
4. Generator
5. Nipple - Generator Lubrication

Figure 7 -2A: Generator Lubrication

8. Make sure the "O" ring is in place in the end frame and then carefully press against the inner race to force the double row bearing into place in the end frame.

9. Assemble the gasket and retainer plate. Refer to Figure 7-2A for grease nipple location.

REASSEMBLY

Reassembly is the reverse of disassembly. If the bearings are removed from the drive end frame, follow the procedure for reassembly as covered in the preceding section. If the bearings are not removed from the end frame, use care when pressing the shaft over the bearings to avoid placing undue stress on the bearings.

After reassembling the generator, check for rated output as listed previously.

GENERATOR TROUBLE SIGNS

Bearing trouble is preceded by a metal-to-metal squeal before failure. Normally, a dead battery or low charging rate is the result of some relatively minor condition in the system. Some of the most common are:

(A) LOOSE OR SLIPPING BELT—If the belt is worn, replace it and look for the cause. Pulley alignment is critical; a misalignment of more than 1/32 inch either side off center will adversely affect the belt. Use an accurate straightedge to correct pulley alignment.

A howl or squeal during starting and sudden acceleration indicates a loose belt. The pulley and belt will become glazed if the condition continues. Clean the pulley grooves with heavy-duty solvent and replace the belt.

(B) OPERATING ACCESSORIES WITH ENGINE OFF—Even with greatly increased generating efficiency of a generator system, it only works with the engine running. If electrical accessories are operated with engine off, the battery will be drained. Check the generator output and the regulator setting; if properly set, the system should function as required.

VOLTAGE REGULATOR

DESCRIPTION

The 24-Volt regulator is a transistor type located (Prior to Unit No. 11100) at the left rear of the coach. (Effective Unit No. 11101) is located in rear R.H. baggage compartment.

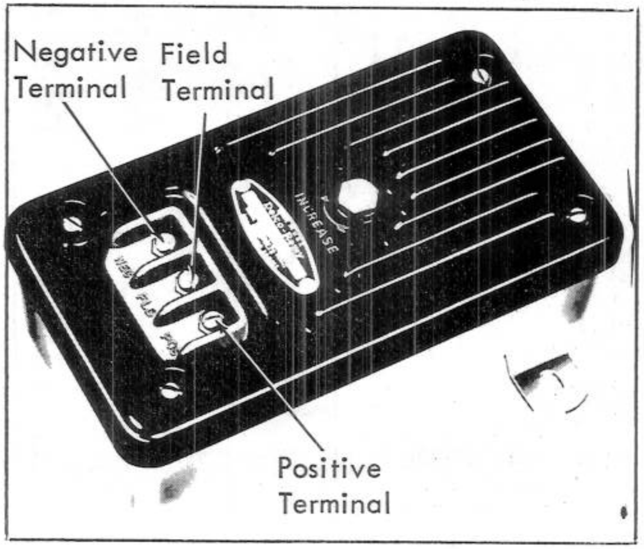


Figure 7 - 3: 24-Volt Regulator Assy.

The regulator components work together to limit the generator voltage to a pre-set value by controlling the generator field current. This is the only function the regulator performs in the charging circuit.

The voltage at which the generator operates is determined by the regulator adjustment. Once adjusted, the generator voltage remains constant, since the regulator is unaffected by length of service, changes in temperature, or changes in generator output and speed.

Trouble in the electrical system will usually be indicated by one of two conditions-an undercharged battery or an overcharged battery. Either condition can result from an improper voltage regulator setting.

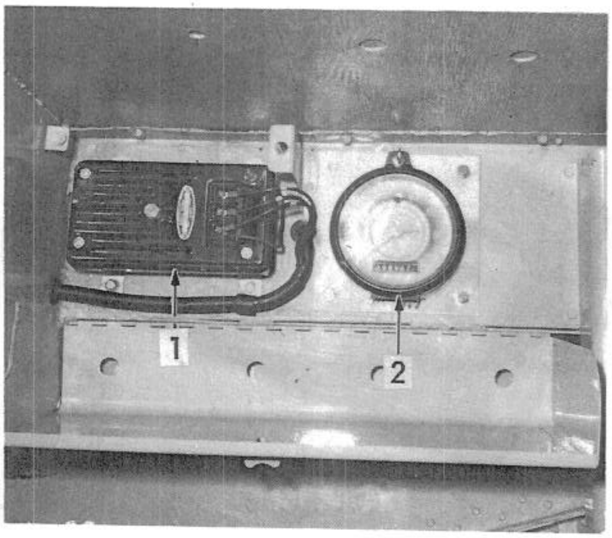
The ideal voltage setting is the one which will maintain the batteries in a fully charged condition with a minimum use of water. A record of water usage and battery specific gravity checks over a service period of reasonable length will establish the ideal voltage setting for the vehicle involved.

The correct voltage regulator setting will vary according to the rate at which the batteries will absorb the charge without detrimental effect. The rate at which the batteries will absorb the charge in turn varies with such factors as battery age and condition, and outside ambient temperatures.

The ideal setting is one which will maintain the batteries in a fully charged state with minimum use of water by the batteries.

Under ordinary conditions of battery age and condition, at prevailing ambient temperatures of up to 70° F, a voltage setting of 27.6 volts has been found to be an approximate average.

Under ordinary conditions of battery age and condition, and at prevailing ambient temperatures of over 70° F, a voltage setting of 27.5 volts has been found to be an approximate average.



1. Voltage Regulator
2. Tachograph

Figure 7 - 3A: Voltage Regulator Installed

However, these figures are merely a guide and final adjustment should be made on the basis of battery charge and water consumption.

CHECKING THE VOLTAGE SETTING

To check the voltage setting, connect a voltmeter across the "Pos" and "Neg" terminals on the regulator, and an ammeter at the D.C. terminal on the generator (Figure 7-5). Operate the engine at approximately 1000 r.p.m. (about 2300 generator r.p.m.) with accessories turned on to obtain 20-200 amperes generator output, and note the voltage setting. The voltage should be steady and reasonably close to specification. Desired variations in setting can be obtained by removing the plug from the voltage regulator cover and turning the adjusting screw inside the regulator. This will change the voltage to meet the needs dictated by operating conditions.

UNDERCHARGED BATTERY: If the voltage setting as checked above is steady and reasonably close to the specified value and the battery is undercharged, raise the setting by .3 volt and check for an improved battery condition over a minimum service period of 48 hours. If the voltage cannot be adjusted to the desired value, the generator should be checked as follows:

Stop generator, turn off all accessories and disconnect battery ground strap. Disconnect all leads from the regulator and from the generator field.

CAUTION DO NOT ALLOW LEADS TO TOUCH GROUND.

Connect a voltmeter and ammeter in the circuit at the D.C. terminal on the generator. Connect a jumper lead from the generator D.C. terminal to the generator field terminal. Connect a carbon pile load across the battery. Turn to off position. See Figure 7-6 for wiring connections. Reconnect battery ground strap. Turn on all vehicle accessories. Operate generator and adjust carbon pile load as required to check for rated output.

To check the generator field winding, proceed as outlined under "Generator-24-Volt" above.

OVERCHARGED BATTERY: If the voltage setting as checked above is steady and reasonably close to the specified value, lower the setting by .3 volt and check for an improved battery condition over a minimum service period of 48 hours. If the voltage cannot be adjusted to the desired value, proceed as follows:

A shorted or grounded field or a defective regulator can cause an overcharged battery. The field winding can be checked as covered in "Undercharged Battery" above. If the field winding is found not to be defective, the generator is not defective, and the regulator should be checked as covered in section entitled "Regulator Checks."

REGULATOR CHECKS

In the event of voltage regulator failure, before replacing the failed regulator proper tests should

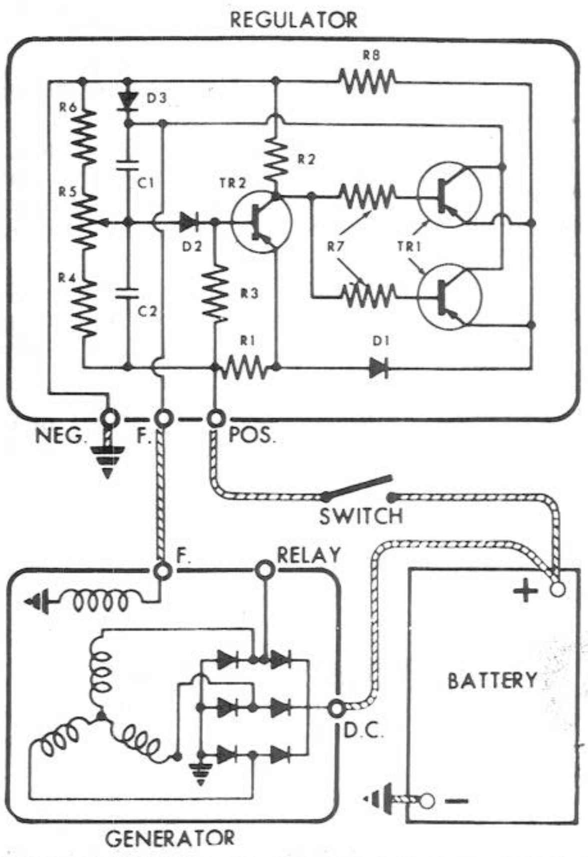


Figure 7 - 4: 24-Volt Reg. Wiring Diagram

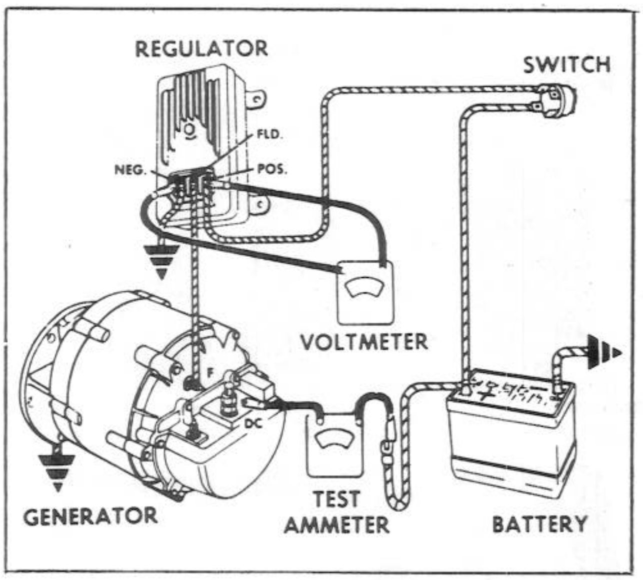


Figure 7 - 5: Reg. Voltage Adjustment Test

be made of the field current draw of the alternator circuit to make sure that a shorted or partially-shorted field coil has not caused premature failure of the voltage regulator.

Before making electrical checks, visually inspect the wire-wound resistors (Figure 7-7) for opens, and make sure all soldered connections are secure. Various electrical checks with an ohmmeter can be made to determine which components are defective. The component parts are identified in Figures 7-7 and 7-8.

The ohmmeter must be accurate, and must be one which uses a 1½ volt dry cell. Also, the ohmmeter polarity must be determined by connecting its leads to voltmeter leads.

The voltmeter will read up-scale when the negative leads are connected together and the positive leads are connected together. The polarity of the voltmeter leads can be determined by connecting its leads to the identified terminals of a battery.

When making checks, note carefully in the illustrations how the ohmmeter is connected with regards to polarity, and select a scale such that the 10 ohm reading is at or near mid-scale. In general, the 10 ohm reading should be within, or very nearly within, the middle third of the scale.

It is important that the following checks be made in the order listed. If a defective part is found, replace it before proceeding with the remaining checks. Be sure to make all the checks as more than one component may be defective.

A defective part may be replaced by removing any attaching screws involved and unsoldering the connections. To replace the parts identified in Figure 7-8, separate the printed circuit board from the cover by removing the eight attaching screws shown in Figure 7-7. When resoldering, limit solder time to a minimum as excessive heat may damage the printed circuit and component parts.

CAUTION Good soldered connections are essential for satisfactory operation. A rosin core 63% tin 37% lead solder with 360 °F melting point is recommended along with a soldering iron rated at 50 watts or less. Use extreme care to avoid overheating.

ZENER DIODE: To check the zener diode (Figure 7-10). Unsolder the connection and lift the lead up just enough to separate the lead from the printed circuit. Bending the lead too far may cause it to break off inside the diode. Then connect the ohmmeter leads as shown in Figure 7-9. If the reading is zero, the diode is shorted. If the reading is very high (infinite) the diode is open. Re-solder the diode lead before proceding.

POTENTIOMETER: If either reading is 100 ohms or above with the ohmmeter connected as shown in Step 1 and Step 2 in Figure 7-9 the potentiometer (Figure 7-7) is open.

FILTER CONDENSER: To check the filter condenser, Figure 7-8, connect the ohmmeter as shown in Figure 7-9. A zero reading indicates a shorted filter condenser. To check for opens, inspect the two soldered connections.

FEED-BACK CONDENSER: A shorted feed-back condenser Figure 7-8 will give a zero reading with ohmmeter connected as shown in Figure 7-9. To determine if the condenser lead is open, carefully inspect the condenser lead at the soldered connection.

FIELD DISCHARGE DIODE: The field discharge diode (Figure 7-8) is shorted if a zero reading is obtained with the ohmmeter connected in Figure 7-9. If the reading is very high (infinite), the diode is open. Note that the diode lead has been unsoldered and that the ohmmeter is connected to the diode lead and to the attaching nut. Re-solder the diode lead before proceeding with other checks.

BACK BIAS DIODE: Check the back bias diode (Figure 7-8) by connecting the ohmmeter as shown in Figure 7-10. A zero reading indicates a shorted

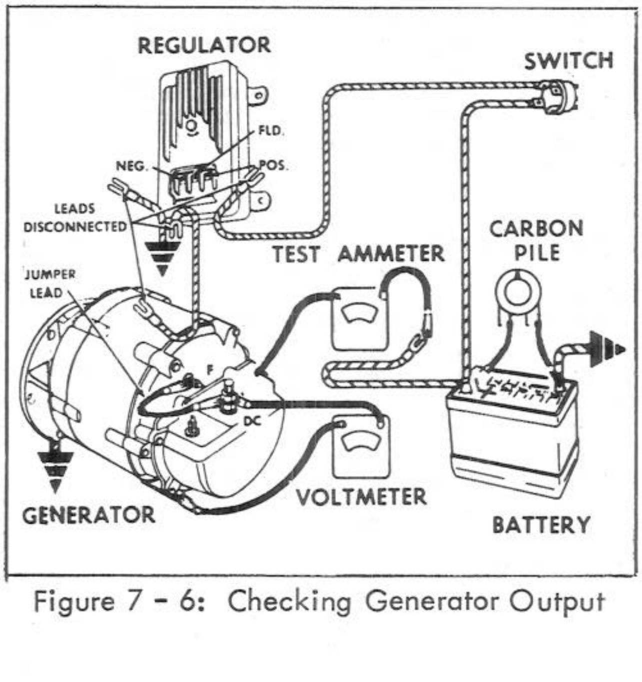
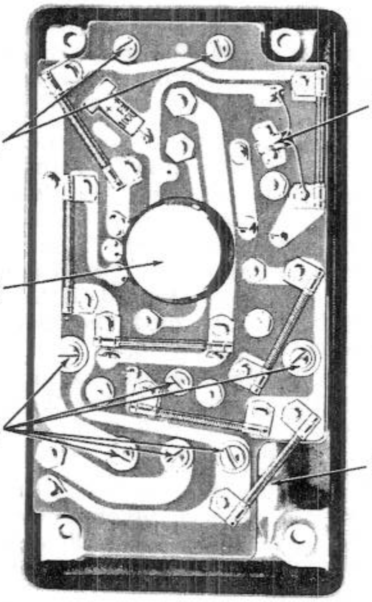


Figure 7 - 6: Checking Generator Output



1. Attaching Screws
2. Zener Diode
3. Potentiometer
4. Attaching Screws
5. Wire - Wound Resistor (Total of Seven on Panel)

Figure 7 - 7: Regulator Circuit Panel Board

diode and a reading over 100 ohms. indicates an open diode.

SHORTED POWER TRANSISTOR: Check the power transistors (Figure 7-8) by connecting the ohmmeter the three ways shown in Figure 7-10. If any reading is zero ohms, one of the power transistors is shorted. To determine which power transistor is shorted, remove the upper transistor (Figure 7-8) and repeat the check as shown in Figure 7-10 on the transistor which is still mounted on the printed circuit board. If any of the three readings is zero, the transistor is shorted. Also check the transistor which has been removed by connecting the ohmmeter the three ways shown in Figure 7-10. A zero reading in any one of the three checks indicates a shorted transistor.

SHORTED DRIVER TRANSISTOR: The driver transistor (Figure 7 - 11) is shorted if any reading is zero with the ohmmeter connected the three ways shown in Figure 7-10.

OPEN TRANSISTORS: The power transistors (Figure 7-8) and the driver transistor (Figure 7-8) may be checked for opens by removing the transistors from the panel board and connecting the ohmmeter to each. A very high (infinite) reading in either check indicates an open transistor.

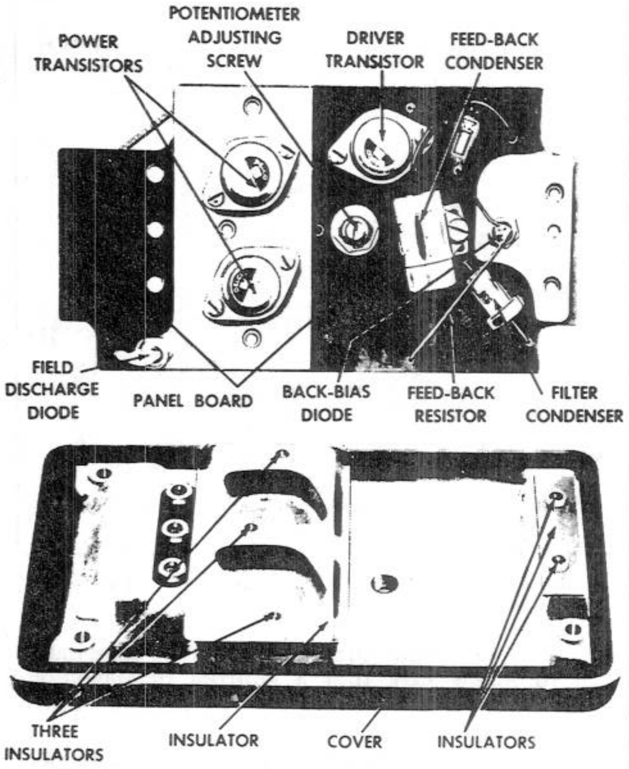


Figure 7 - 8: Underside of Circuit Panel

When attaching the panel board to the cover, note the location of the insulators as shown in Figure 7-8 Also, visually re-check all soldered connections and the wire-wound resistors for opens.

STARTING MOTOR

DESCRIPTION

The starting motor has the shift lever and solenoid plunger that are totally enclosed to protect them from exposure to dirt, icing conditions and splash.

Positive lubrication is provided to the bronze bushing located in the commutator end frame, in the lever housing and in the hose housing, by an oil saturated wick that projects through each bushing and contacts the armature shaft.

The clutch is a Positork drive type, moved into mesh with the ring gear by the action of the solenoid. Once engaged, the clutch will not disengage during intermittent engine firing, which prevents damage to pinion and ring gear teeth. The pinion remains engaged until starting is assured and the solenoid circuit is interrupted.

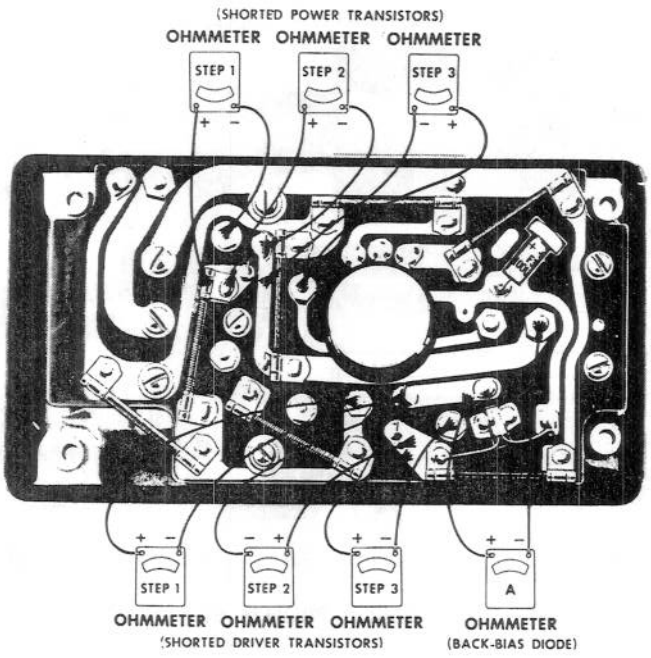

(SHORTED POWER TRANSISTORS)
OHMMETER
OHMMETER
OHMMETER
STEP 1
STEP 2
STEP 3
+ -
+ -
- +
+ -
- +
+ -
+ -
STEP 1
STEP 2
STEP 3
A
OHMMETER
OHMMETER
OHMMETER
(SHORTED DRIVER TRANSISTORS)
OHMMETER
(BACK-BIAS DIODE)

Figure 7 - 9: Ohmmeter Checks of 24-Volt Regulator

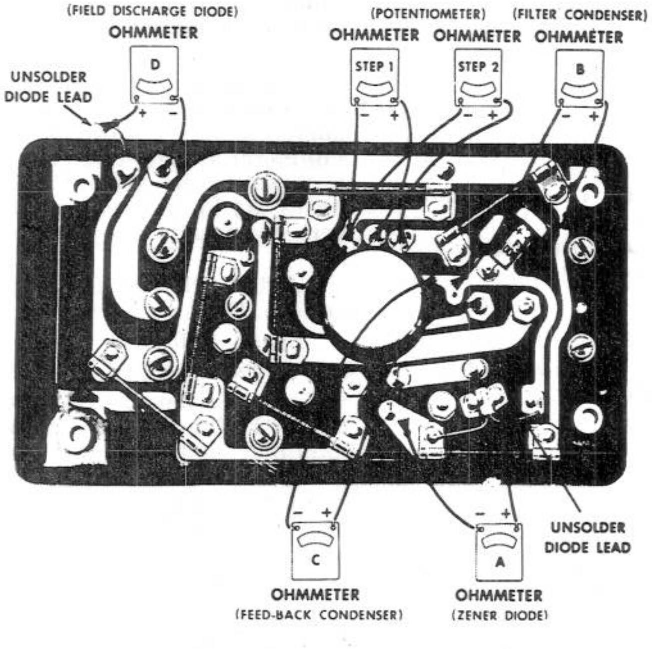

(FIELD DISCHARGE DIODE)
OHMMETER
D
UNSOLDER
DIODE LEAD
+ -
(POTENTIOMETER)
(FILTER CONDENSER)
OHMMETER
OHMMETER
OHMMETER
STEP 1
STEP 2
B
- +
- +
- +
- +
C
OHMMETER
(FEED-BACK CONDENSER)
- +
A
OHMMETER
(ZENER DIODE)
UNSOLDER
DIODE LEAD

Figure 7 - 10: Ohmmeter Checks of 24-Volt Regulator

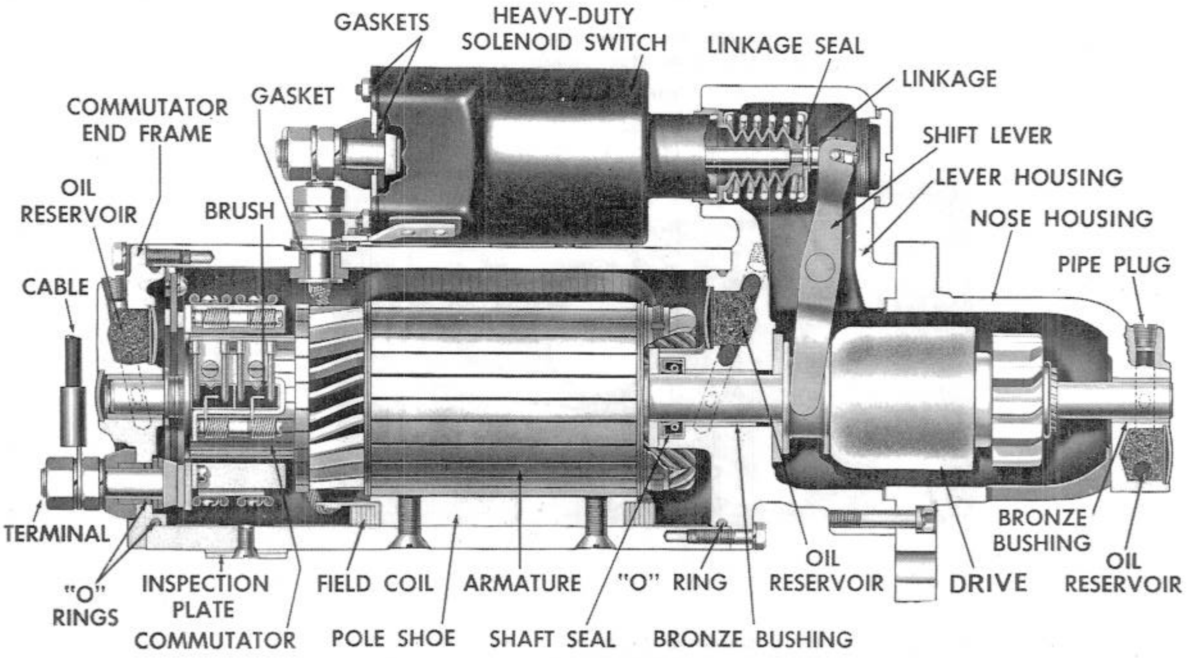

GASKETS
HEAVY-DUTY SOLENOID SWITCH
LINKAGE SEAL
LINKAGE
COMMUTATOR END FRAME
GASKET
SHIFT LEVER
LEVER HOUSING
OIL RESERVOIR
BRUSH
NOSE HOUSING
PIPE PLUG
CABLE
TERMINAL
BRONZE BUSHING
OIL RESERVOIR
"O" RINGS
INSPECTION PLATE
FIELD COIL
ARMATURE
"O" RING
OIL RESERVOIR
DRIVE
COMMUTATOR
POLE SHOE
SHAFT SEAL
BRONZE BUSHING

Figure 7 - 11: Starting Motor Construction

MAINTENANCE

Under normal operating conditions, no maintenance will be required between engine overhaul periods. At time of engine overhaul, the starting motor should be disassembled, inspected, cleaned and tested.

It should be noted that six Allen head capscrews, (5 per 5/16 - 18 x 1-1/2" lg. and 1 per 5/16 - 18 x 55/64" lg.) that retain the cranking motor lever housing to the nose housing are to be torqued to 13-17 ft. lbs. It is recommended that the above torque be checked when servicing or inspecting the starter drive.

NOTE: When removing the nose housing from the lever housing, mark both prior to disassembly so reassembly will follow in the same order.

STARTING MOTOR TESTS

Never operate the starting motor more than 30 seconds at a time without pausing to allow it to cool for at least 2 minutes. Overheating, caused by excessive starting will seriously damage the starting motor.

To obtain full performance data on a starting motor, or to determine the cause of abnormal operation, the starting motor should be subjected to the following tests. These tests are performed with the starting motor removed from the engine. Failure of the starting motor to perform according to specifications will require disassembling the motor for further checks and adjustments.

NO LOAD TEST: Connect the starting motor in series with fully charged batteries, to give 24 volts, an ammeter capable of reading several hundred amperes, and a variable resistance. Also connect a voltmeter as illustrated in Figure 7 - 15 from the motor terminal to the motor frame. An R.P.M. indicator is necessary to measure armature speed. Proper voltage can be obtained by varying the resistance unit.

CAUTION The following test requires extreme caution. Follow directions carefully.

LOCK-TORQUE TEST: The lock-torque test requires the equipment illustrated in Figure 7-13 . A variable resistance with a high current capacity should be used. The starting motor should be SECURELY mounted and a brake arm hooked to the drive pinion. When specified current is applied, the torque can be computed from the reading on the scale. A one foot brake arm will directly indicate pound feet.

DISASSEMBLY

Normally the starting motor should be disassembled only so far as is necessary to make repair or replacement of the defective parts.

Note the relative position of the solenoid, lever housing, and nose housing so the motor can be

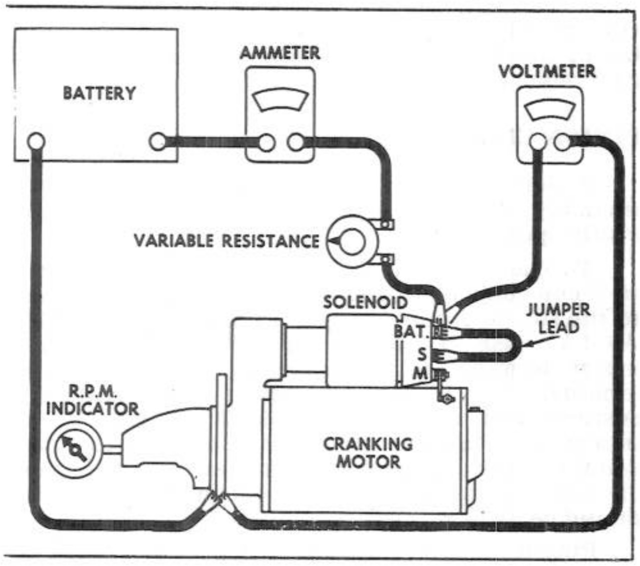


Figure 7 - 12: Circuit for No-Load Test

reassembled in the same manner. Disconnect field coil connector from solenoid motor terminal, and lead from solenoid ground terminal. On motors which have brush inspection plates, remove the plates and then remove the brush lead screws. This will disconnect the field leads from the brush holders.

Remove the attaching bolts and separate the commutator end frame from field frame. Remove armature and clutch assembly from lever housing. Separate solenoid from lever housing by pulling apart.

CLEANING

The drive mechanism armature and fields should not be cleaned in any degreasing tank, or with grease dissolving solvents, since these would dissolve the lubricants in the drive mechanism and damage the insulation in the armature and field coils. All parts except the drive should be cleaned with mineral spirits and a brush. The drive can be wiped with a clean cloth.

If the commutator is dirty it may be cleaned with No. 00 sandpaper.

CAUTION NEVER USE EMERY CLOTH TO CLEAN COMMUTATOR.

ARMATURE SERVICING

If the armature commutator is worn, dirty, out of round, or has high insulation, the armature should be put in a lathe so the commutator can be turned down. The insulation should then be cut 1/32 of an inch wide and 1/32 of an inch deep, and the slots cleaned out to remove any trace of dirty or copper dust. As a final step in this procedure, the commutator should be sanded lightly with No. 00 sandpaper to remove any burrs left as a result of the undercutting procedure.

The armature should be checked for opens, short circuits and grounds as follows:

OPENS: Opens are usually caused by excessively long starting periods. The most likely place for an open to occur is at the commutator riser bars. Inspect the points where the conductors are joined to the commutator bars for loose connections. The poor connections cause arcing and burning of the commutator bars as the starting motor is used. If the bars are not too badly burned, repair can often be effected by resoldering the leads in the riser bars (using rosin flux), and turning down the commutator in a lathe to remove the burned material. The insulation should then be undercut.

SHORT CIRCUITS: Short circuits in the armature are located by use of a growler. When the armature is revolved in the growler with a steel strip such as a hacksaw blade held above it, the blade will vibrate above the area of the armature core in which the short circuit is located. Shorts between bars are sometimes produced by brush dust or copper between the bars. These shorts can be eliminated by cleaning out the slots.

GROUNDS: Grounds in the armature can be detected by the use of a 110-volt test lamp and test points. If the lamp lights when one test point is placed on the commutator with the other point on the core or shaft, the armature is grounded. Grounds occur as a result of insulation failure which is often brought about by overheating of the starting motor produced by excessively long starting periods or by accumulation of brush dust between the commutator bars and the steel commutator ring.

FIELD COIL CHECKS

The field coils may be checked for grounds and opens by using a test lamp.

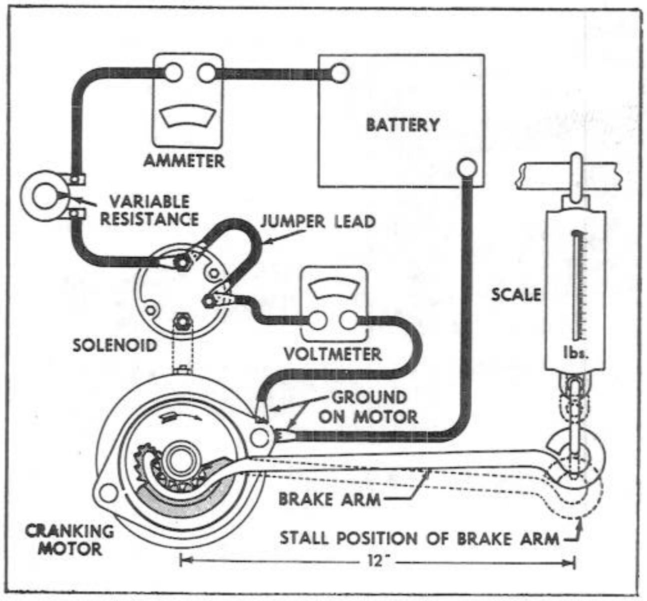


Figure 7 - 13: Circuit for Lock Torque Test

GROUNDS: If the motor has one or more coils normally connected to ground, the ground connections must be disconnected during this check. Connect one lead of the 110-volt test lamp to the field frame and the other lead to the field connector. If the lamp lights, at least one field coil is grounded which must be repaired or replaced.

OPENS: Connect test lamp leads to ends of field coils. If lamp does not light, the field coils are open.

FIELD COIL REMOVAL

Field coils can be removed from the field frame assembly by using a pole shoe screwdriver. A pole shoe spreader should also be used to prevent distortion of the field frame. Careful installation of the field coils is necessary to prevent shorting or grounding of the field coils as the pole shoes are tightened into place. Where the pole shoe has a long lip on one side and a short lip on the other, the long lip should be assembled in the direction of armature rotation so it becomes the trailing (not leading) edge of the pole shoe.

REASSEMBLY

The reassembly is the reverse of disassembly.

To reassemble the end frame having eight brushes onto the field frame, pull the armature out of the field frame just far enough to permit the brushes to be placed over the commutator. Then push the commutator end frame and the armature back against the field frame.

The recommended torque for the cross-slotted pole shoe screws is 25-35 ft. lbs.

LUBRICATION

All wicks and oil reservoirs should be saturated with SAE #10 oil. The splines underneath the drive (on the shaft) should be wiped clean but not oiled. Oil in this area may cause failure to engage at very cold temperatures.

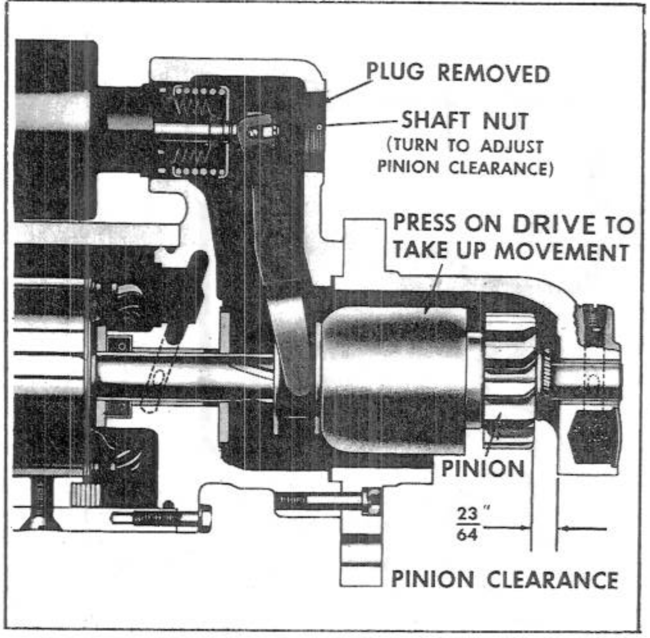

PLUG REMOVED
SHAFT NUT
(TURN TO ADJUST PINION CLEARANCE)
PRESS ON DRIVE TO TAKE UP MOVEMENT
PINION
23"/64
PINION CLEARANCE

Figure 7 - 14: Pinion Clearance Adjustment

PINION CLEARANCE

Pinion clearance should be checked after reassembly of motor to make sure the clearance is within specifications.

To check pinion clearance, disconnect the motor field coil connector from the solenoid motor terminal to the solenoid frame or ground terminal. MOMENTARILY flash a jumper lead from the solenoid motor terminal to the solenoid frame or ground terminal. The pinion will now shift into starting position and remain so until the battery is disconnected. Push the pinion back towards the commutator end to eliminate slack movement. Measure the distance between pinion and pinion stop. This should be 23/64 ± 1/32.

Pinion clearance is adjusted to these limits by turning the solenoid shaft nut after removing access plug in shift housing. See Figure 7 - 14 .

STARTER SOLENOID

DESCRIPTION

The starting motor solenoid shifts the starting motor pinion into mesh with the flywheel ring gear and also closes the electrical circuit to energize the starting motor.

There are two windings in the solenoid: a pull-in winding and a hold-in winding. Both windings are energized when the external control switch is closed. They produce a magnetic field which pulls the plunger in so that the drive pinion is shifted into mesh, and the main contacts in the solenoid switch are closed to connect the battery directly to the starting motor. Closing of the main switch contacts shorts out the pull-in winding since this winding is connected across the main contacts. The magnetism produced by the hold-in winding is sufficient to hold the plunger in, and shorting out the pull-in winding reduces drain on the battery. When the control switch is opened, it disconnects the hold-in-winding from the battery. When the hold-in winding is disconnected from the battery the shift lever spring withdraws the plunger from the solenoid, opening the solenoid switch contacts and at the same time withdrawing the drive pinion from mesh. Proper operation of the switch depends on maintaining a definite balance between the magnetic strength of the pull-in and hold-in windings.

This balance is established in the design by the size of wire and the number of turns specified. An open circuit in the hold-in winding or attempts to start with a discharged battery may cause the switch to chatter.

DISASSEMBLY

To disassemble the solenoid, remove nuts, washers, and insulators from the switch terminal and battery terminal. Unscrew cover screws and remove cover. Take out the contact disk assembly.

SOLENOID TESTS

Two tests must be made to determine the current draw of (1) both windings in parallel and (2) the hold-in winding alone. The solenoid windings can be tested with the solenoid either off or on the startin motor. However, when the solenoid is checked on the starting motor, it is necessary to disconnect both leads at the main solenoid terminals to prevent interference. The main solenoid terminal which is normally connected to the starting motor must then be grounded to the solenoid base by means of a jumper lead. For the first test, connect a source of variable voltage (battery and a variable resistance) in series with an ammeter between the solenoid base and the solenoid small switch terminal. Connect a voltmeter between the same two points. Slowly increase voltage and note the current draw. This should be 55 - 63 amps at 24 volts. Disconnect the jumper lead grounding the main solenoid terminal and readjust the variable resistance to obtain the specified voltage of 24 volts. This should not exceed 6.8 amps.

When the solenoid has been removed from the starting motor for repair or replacement, the linkage must be adjusted to provide the correct pinion clearance when the solenoid is remounted on the starting motor. See "Starting Motor" earlier in this section for correct pinion clearance adjustment.

BATTERIES

DESCRIPTION

Two 12-Volt batteries are connected in series, mounted in roll-out trays in a compartment behind the right wheelhousing. Battery cells may be checked and filled at this point.

IMPORTANT: Observe decal on inside of battery compartment for proper connections.

The battery has three major functions to perform on the vehicle.

(1) It provides a source of current for starting the engine.
(2) It acts as a stabilizer to the voltage in the electrical system.
(3) It can, for a limited time, furnish current when electrical demands of the electrical equipment exceed the output of the generator.

In replacing batteries, only batteries of the same specification should be used. Refer to "Specifications" at the end of this section.

The electrical system is negative ground, with the negative battery terminal connected to the coach frame.

CAUTION: Make certain that connections are not reversed, since damage to electrical system components will result.

IMPORTANT: After battery cables have been disconnected, wrap terminal with electrical tape or equivalent to prevent accidental grounding.

Electrolyte level in the battery should be checked at least every 1,000 miles or every week. If the electrolyte level is found to be low, water should be added to each cell until the level rises to the bottom of the vent well.

NOTE: Do not overfill cells.

Level of electrolyte can be checked by the use of a flashlight and mirror. Hold mirror over each cell opening and direct flashlight beam so level can be seen.

Distilled water should be used to eliminate the possibility of impurities being added to the electrolyte. NOTE: Do not add any substance to the electrolyte except water.

The freezing point of the electrolyte depends upon its specific gravity. The following table gives freezing temperatures of various specific gravities.

SPECIFIC GRAVITY	FREEZING TEMP.
1.100	+ 18 °F.
1.120	+ 14 °F.
1.140	+ 8 °F.
1.160	+ 2 °F.
1.180	- 6 °F.
1.200	- 17 °F.
1.220	- 31 °F.
1.240	- 51 °F.

(1) Check voltage drop between grounded battery terminal (negative) and vehicle frame. With the starting motor turning over, the voltage reading should be less than 0.3 volts. If more, there is excessive resistance in circuit.

(2) Check voltage drop between positive terminal of battery and starting motor terminal stud while starting motor is operating. If the reading is more than 1.0 volts, the resistance is excessive.

(3) Check voltage drop between the starting motor housing and the bus frame. If over 0.2 volts, the resistance is excessive.

CLEANING AND INSPECTION

The external condition of the battery and the battery cables should be checked periodically. The top of the battery should be kept clean and the battery hold-down bolts should be kept properly tightened. Neutralize all acid with soda and water solution. Flush trays and battery compartment thoroughly with water. Care must be taken to keep vent plugs tight so that the neutralizing solution does not enter the cells. Repair damage done by acid as required. Scrape all paint bubbles to bare metal. After drying, repaint interior of the battery compartment and the trays with #701 Red-Con-Treat Paint. Be sure to check all grommets and cable hangers for possible damage to cables. The hold-down bolts should be kept tight enough to prevent the battery from shaking in its holder, but should not be tightened excessively as to place strain on the battery case. NOTE: Batteries must be replaced in matched pairs.

To ensure good contact, the battery cables clamps should be tight on the battery posts. If the posts or cable clamps are corroded, the cables should be disconnected and the posts and clamp cleaned separately with soda solution and a wire brush. Install clamps on battery posts and tighten firmly, then coat posts and clamp with petroleum jelly to help prevent corrosion.

BATTERY TESTS

Place a load on batteries with starter for 30 seconds and turn on headlights - low beam - 20 amp. draw—and leave on while using an expanded scale volt meter of .01 scale divisions, check all cells for capacity. If all cells read 1.95 Volts or more with less than .05 volts difference between highest and lowest cell reading, battery is good and sufficiently charged.

NOTE: Batteries must be charged in pairs. At no time will only one battery be replaced. The regulator is controlled by the counter voltage in good batteries. Therefore, the weak battery will never come up and eventually the good battery will fail.

CHECK SPECIFIC GRAVITY

Use a temperature-correcting hydrometer to measure the specific gravity of each cell. If each cell has a specific gravity of 1.180 or above, and there is a difference of 50 points or more between the highest and the lowest cell, replace the battery. EXCEPTION: If any cell has a specific gravity of below 1.180, perform "Battery Charge" described later. NOTE: If the electrolyte level in any cell is too low to produce a reading, add water to the battery and perform "Battery Charge" described later.

BATTERY CHARGE

If battery is under 1.230 specific gravity, it must be charged. If the specific gravity reading is less than .050 points between lowest and highest cell, recharge for 24 hours at 12 to 15 amps and 15 volts. Battery is fully charged when reading is checked consecutive hours and no increase is noted. A full charge reading of 1.230 or less is defective and must be activated or scraped.

NOTE: Highly sulfated batteries may have to be charged at 16 or 17 volts start current to flow through the battery, then reduce rate to regular charge 15 volts.

NOTE: Do not allow electrolyte temperature to go above 125° F.

HIGH RATE DISCHARGE TEST

Never check a battery in a discharge state. Specific gravity must be above 1.230 for the high rate discharge test. If battery was slow-charged, it should stand 8 to 10 hours between performing high rate discharge.

HOOK UP

The battery leads must be connected to the battery, red to positive, black to negative. Turn the voltmeter selector to the 16 volt position. Connect the voltmeter leads to the battery posts.

TEST PROCEDURE

Turn the load selector clockwise until the upper scale of the D.C. amperes meter reads two times the ampere-hour rating of the battery. Hold this load on for 15 seconds. While the load is on, read the battery terminal voltage on the 16 Volt scale of the D.C. Volts meter. Turn all controls to off and disconnect the tester.

NOTE: If the terminal voltage reads 10.6 or more, the battery is good.

COMMON CAUSES OF BATTERY FAILURE

When a battery fails, the cause of failure may be outside the battery. For this reason, locate and correct the cause of the failure to prevent recurrence. Some common causes of battery failure are as follows:

(1) Defect in generating system such as high resistance or faulty generator or regulator.
(2) Defective starter or excessive use of accessories.
(3) Dirt and electrolyte on top of batteries.
(4) Hardened battery plates, due to battery being in a low state of charge over a long period of time.
(5) Shorted cells, loss of active material from plates.
(6) Driving conditions or requirements under which the vehicle is used only for short drives.

CAUTION: When making the above checks, make certain the engine does not start accidentally.

EQUIPMENT REQUIRED TO PERFORM ELECTRICAL SYSTEM CHECKS

(A) Salt brine load stack unit which included the following items:
(1) Load stack electrode.
(2) 28 to 30 gallon plastic can.
(3) One (1) cart with casters. Cart size 30'' high x 18'' wide x 24'' long.
(4) One (1) 0 to 500A external shunted amp. meter to read generator output.
(5) One (1) 0-15A amp. meter to be wired in series with a 10A circuit breaker (reset type) and variable rheostat in field coil circuit.
(6) One (1) 200 Watt and 150 ohm variable rheostat.
(7) One (1) 10A circuit breaker (reset type).
(8) One (1) 0 to 30V Voltmeter
(9) One (1) 50 M.A. external shunt, for 500A amp. meter.
(10) One (1) Model 10W-12 heath oscilloscope to be mounted on cart along side instrument board (at location desired only).
(11) Two (2) pair 6'' Vice-grip pliers to make fast hookup to coach circuit.
(12) Two (2) 8 ft. pcs. of size— Welding Cable for leads to load stack electrodes one end and vice grips on other end.

(B) NOTE: The Following items are required in cart for checking and servicing batteries and starter.
(1) One (1) Columbia type AC-DC tong test amp. meter 0-800 amp. scale-plus 0-150 extra scale and carrying case. The tong tester is used to check current draw on engine starter as follows:
    (a) Clamp tongs around battery cable to the starter.
    (b) Spin engine over with starter with fuel rack in no fuel position to prevent engine from cranking. Operate 5 seconds and record reading. Should be both winding 29.5 to 34.6 amps. approx. Hold in windings 4.5 to 6.0 amps.

(C) One (1) exide CA-200 battery tester-analyzer or an expanded scale volt meter of .01 scale divisions to perform the battery light load test. The CA-200 analyzer is recommended. as it will test all type batteries by activating the meter with the electrolyte solution. Same procedure is followed. CAUTION: Battery may be damaged if test probes contact plates.

(D) Wooden battery tool tray painted with creosote.
(E) One (1) battery hydrometer.
(G) Two (2) battery terminal and post cleaner.
(H) One (1) wire brush.
(I) One (1) box baking soda to clean battery and terminals.
(J) One (1) cup of chassis lub and a brush (small) to apply grease to post and terminals to prevent or retard corrosion.
(K) A supply of corrosion resisting felt washers to be placed over battery posts prior to cable terminal installation.

REVERSE SOLENOID

DESCRIPTION

The shift into reverse gear is made with the aid of the reverse solenoid which is mounted on the transmission case. When the "REVERSE" switch on the driver's instrument panel is closed, the solenoid plunger moves the shift fork into position to make the shift into reverse gear using the transmission shift lever.

The reverse solenoid has a pull-in and a hold-in coil. When the reverse solenoid circuit is energized by the action of the switch, both coils are energized and move the plunger into position for the reverse shift. When the plunger has completed its stroke, contact points open to disconnect current to the pull-in coil and only the hold-in coil remaining energized.

ADJUSTMENT

Damage to the solenoid windings may result if contact points do not open at the end of the plunger stroke. Contacts should be closed when the solenoid is in the normal position, and should open when the plunger has reached the limit of its travel.

Solenoid linkage should also be checked if difficulty is experienced in making the shift to reverse gear or if the adjustment has been disturbed in removal of the solenoid unit. The adjustment is made by disconnecting the link and altering the length of the adjusting bolt. The correct linkage adjustment is when the solenoid plunger moves the full length of its stroke before contact points open.

ALARMSTAT

DESCRIPTION

Two alarmstats are installed in the engine to warn the operator of engine overheating by closing the circuit to the "HOT ENG." warning tell-tale light and buzzer on the driver's dash panel.

MAINTENANCE

At general inspection, ground out alarmstats by making contact between terminal post on top of alarmstat and body. Buzzer should sound and light should turn on indicating wiring to be in order. Remove any accumulation of dirt and grease from outside of alarmstats.

1. Body & Paint S/A
2. Spring
3. Base
4. Piston
5. Overtravel Spring
6. Sleeve & Paint S/A
7. "O" Ring
8. Nut
9. Power Element
10. Nut
11. Washer

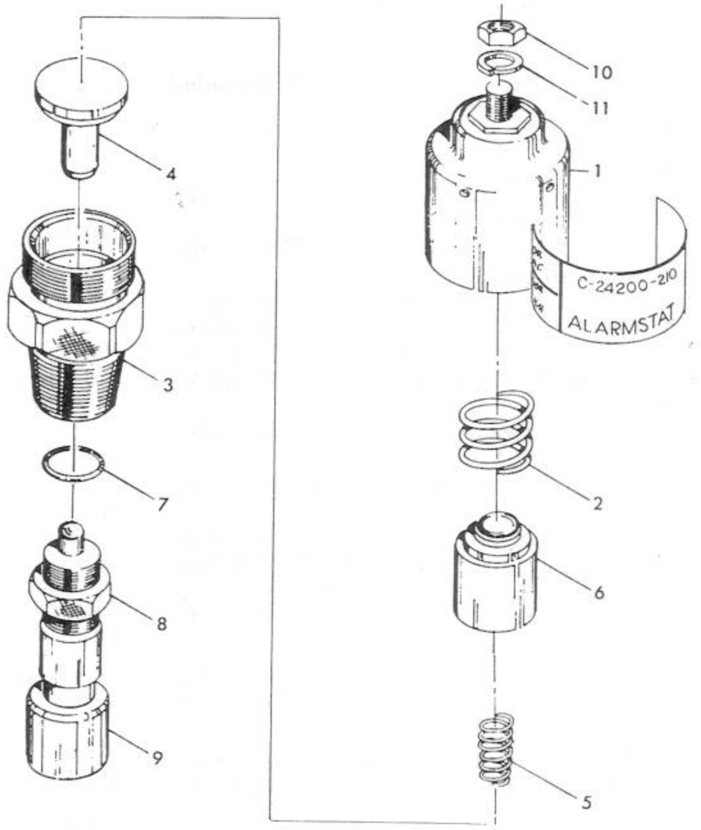


Figure 7 - 15: Alarmstat Assembly

ADJUSTMENT AND TEST

The Alarmstat is adjustable plus or minus 3 degrees. To adjust, position alarmstat base in vise. Without turning or disturbing power element, loosen lock nut. To LOWER temperature setting, turn power element clockwise (into base). One full turn (360°) approximates four degrees. WARNING: Do not grasp power element head with a tool of any kind as this will change the setting and could cause the power element to leak. To INCREASE temperature setting, turn power element counterclockwise (out of base). **IMPORTANT: After adjustment, tighten lock nut to five foot pounds torque. Whenever lock nut is loosened, replace "O" ring. Lubricate "O" ring prior to assembly.** When more than three degrees temperature adjustment is required, replace power element with one of proper temperature setting or return alarmstat direct to factory.

SPEEDOMETER (A-C. WITH ODOMETER)

DESCRIPTION AND OPERATION

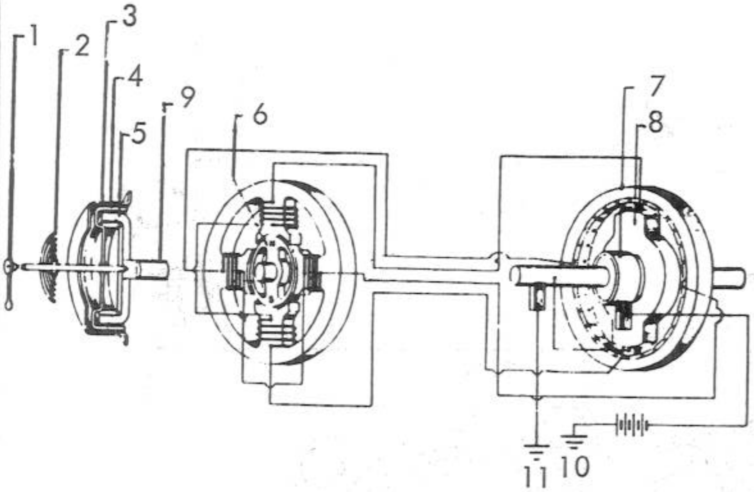
The electric speedometer consists of an electric sending unit driven by means of a short flexible shaft connected to the conventional drive. A four-wire cable is connected to the sending unit and the indicator by A/N type connectors. Battery current is supplied through a single wire to the brush holder on the sending unit. A grounding wire is connected to a ground terminal on the sending unit.

Both the sending and receiving units are sealed against moisture and treated to withstand corrosion.

SENDING UNIT REMOVAL

DESCRIPTION

1. Turn A/N plug until it can be removed from sending unit.
2. Disconnect ground jumper at fuse clip provided.
3. Remove two 1/4" bolts attaching sending unit to mounting bracket.
4. Remove extension casing attaching sending unit to sleeve and pull sending unit out.



1. Pointer
2. Hair Spring
3. Field Plate
4. Aluminum Drag Cup
5. Permanent Magnet
6. Receiving Unit Rotor
7. Resistance Ring
8. Sending Unit Rotor - Mechanically driven from Engine Take-off
9. Shaft - Driven by Receiving Unit Rotor
10. Power Source
11. Ground Terminal

INDICATING AND RECEIVING UNIT

Coils receive two phase alternating current from sending unit each pole changing polarity in sequence and frequency governed by speed of sending rotor.

Figure 7 - 17: Schematic Diagram of Electric Speedometer

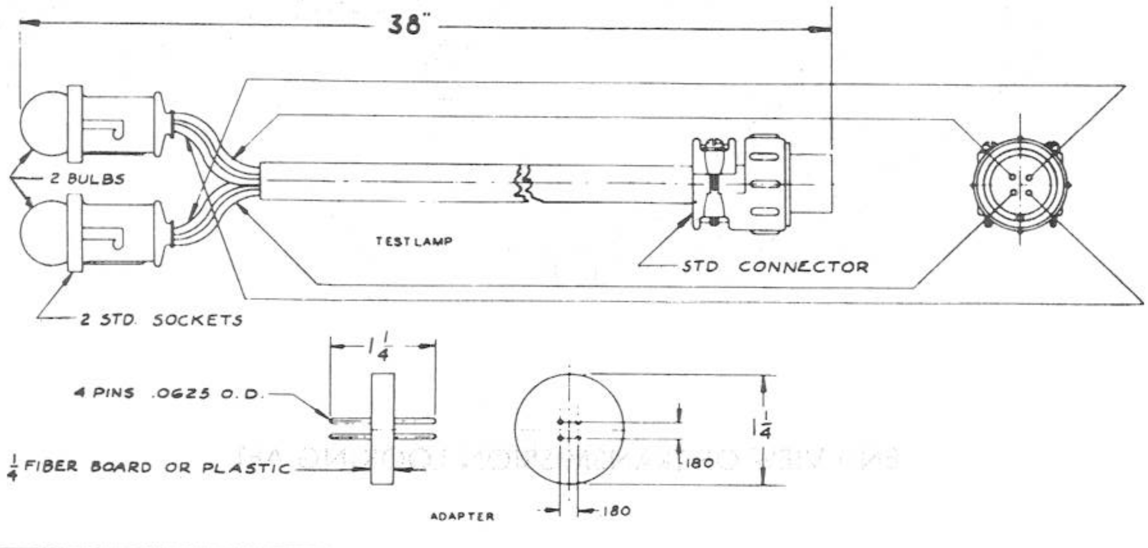


Figure 7 - 18: Test Lamp and Cable Assy.

MAINTENANCE

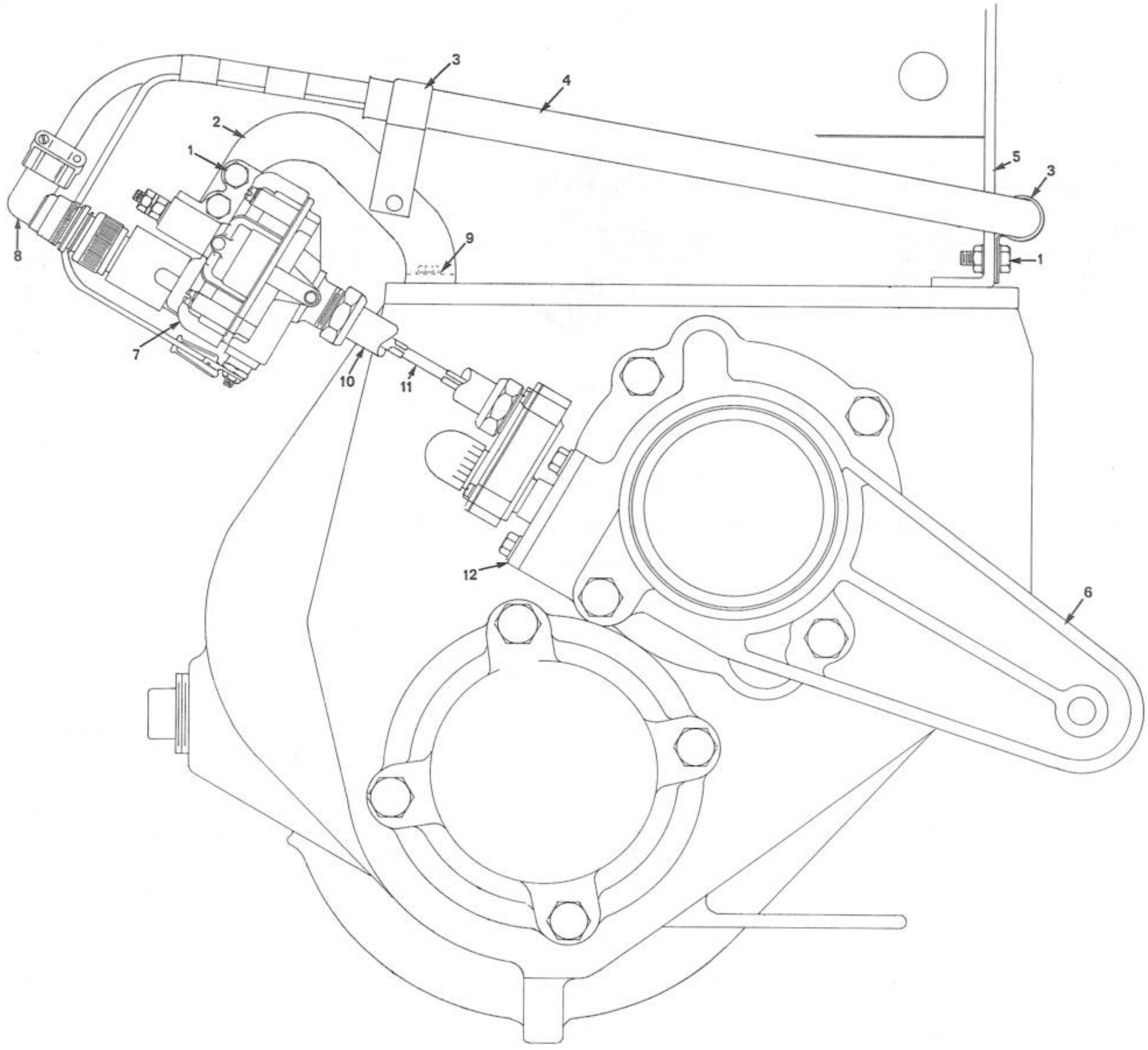
Lubrication of the receiving unit at 100,000 miles and cleaning and lubricating of the sending unit at 60,000 miles is the only maintenance required.

TESTING ON THE VEHICLE

A test lamp and cable assembly as shown in Figure 7-18 is required for testing the speedometer on the vehicle.

Make sure that the bulbs in the test lamp are good and of the correct voltage. Make sure the fuse is not burned out. Disconnect the connector plug from the speedometer on the back of the instrument panel and connect the test cable plug to the adapter and test lamp.

Turn on the master switch and run the vehicle for a short distance. If the test lights alternately grow bright and dim, the sending unit and four-wire cable are functioning properly.



END VIEW OF TRANSMISSION LOOKING AFT

1. 1/4 - 20 N.C. bolt, washer & hex. nut.
2. Mounting Bracket
3. Clamp
4. Tubing
5. Clutch cross shaft mounting bracket.
6. Cap - Main shaft rear bearing
7. Speedometer Sending Unit
8. 90° Angle Plug
9. 3/8" Flat Washer
10. Extension Casing
11. Speedometer Cable Assy.
12. Sleeve

Figure 7 - 19: Speedometer Sending Unit

CAUTION: Testing may also be carried out by disconnecting the lower end of the flexible drive and turning the drive tip by hand.

If test lights do not alternate bright and dim, the trouble may be due to a broken flexible shaft, failure of adapter drive key or adapter, or a fault in the four-wire electrical cable or in the sending unit.

CAUTION: Handle all connectors with care to avoid broken wires or contacts. Make sure rubber covers are used over connectors on sending units to keep out water, oil and dirt.

FIRE DETECTOR

DESCRIPTION

Available as optional equipment is a fire detector kit. An electric sending unit in the rear engine compartment connected to a warning buzzer at the driver's panel warns of over-heated conditions. Installation procedure and schematic follow:

ELECTRIC HORNS

DESCRIPTION

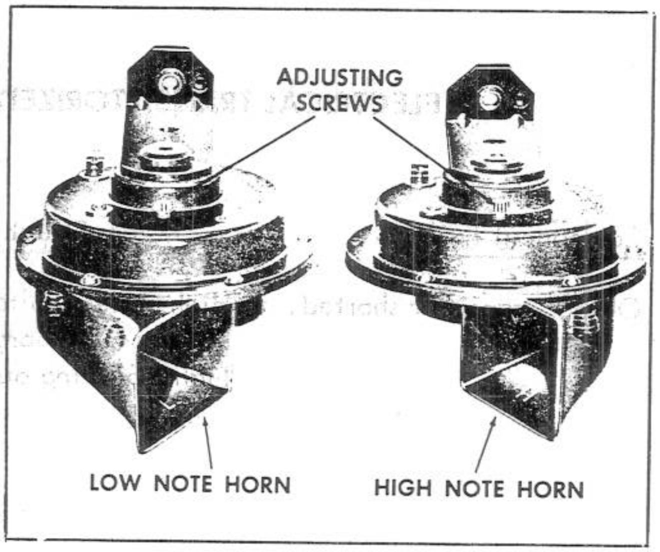

ADJUSTING SCREWS
LOW NOTE HORN
HIGH NOTE HORN

Figure 7 - 21: Electric Horns

The coach is equipped with twin 24-volt electric horns and dual note air horns. Both types are located in the tool compartment at the left hand front side of the coach.

The two air-tone electric horns are operated by pressing a button at the outer edges of the steering wheel. One horn produces a high note and the other a low note.

The air tone is created by a vibrating diaphragm which causes an air column to vibrate.

No maintenance is normally required except a current adjustment of the adjusting screws.

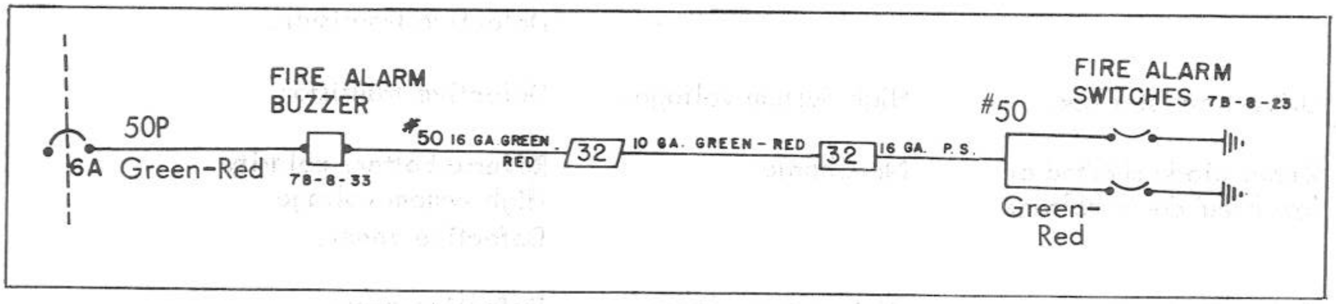

FIRE ALARM BUZZER
50P
6A Green-Red
78-8-33
#50 16 GA GREEN RED
32
10 GA. GREEN - RED
32
16 GA. P.S.
#50
FIRE ALARM SWITCHES 78-8-23
Green-Red

Figure 7 - 20: Fire Detector Installation Schematic

ELECTRICAL TRANSISTORIZED REGULATOR TROUBLESHOOTING

Component Failure	System Effect	Probable Cause
Output transistor shorted.	High system voltage Battery overcharge. Lights burning out.	Negative Grounded Systems: "F" terminal of generator has been grounded. Poor ground in system or poor connection at generator or regulator. Regulator too hot. Ground in wiring between "F" of generator and regulator. Defective transistor. Shorted field in generator Wire harness connections from regulator reversed.
Output transistor open emitter.	No Charge	Severe ground at "F" terminal of generator. Severe ground in wiring between "F" of generator and regulator. Generator field completely shorted.
Drive transistor shorted.	No Charge	Reverse battery polarity. High positive transient from an external source. Defective transistor.
Drive transistor open.	High System voltage.	Defective transistor.
Zener diode shorted or low breakdown voltage.	No Charge	Reverse battery polarity. High system voltage. Defective zener.
Zener diode open	High system voltage.	Defective zener.
Field discharge diode open.	High system voltage.	Reverse battery polarity. Defective diode.
Back bias diode open.	No Charge	Severe ground at "F" of generator and regulator.

Back bias diode open.	No Charge	Severe ground in wiring between "F". and regulator. Generator field completely shorted. Defective diode. Defective output transistor
Back bias diode shorted.	Poor switching which would cause shorted output transistor.	"F" terminal of generator has been grounded. Poor ground in system or poor connection at generator or regulator. Regulator too hot. Ground in wiring between "F" or generator and regulator. Defective transistor. Shorted field in generator. Defective diode.
Filter condenser open	Poor switching may or may not fail output transistor.	Defective connection Defective capacitor.
Filter condenser shorted.	High system voltage.	Defective capacitor. Reversed capacitor polarity.
Feedback condenser shorted.	High system voltage.	Defective capacitor.
Feedback condenser open.	Poor switching which could cause shorted output transistor.	Poor connection. Defective condenser
Open resistor in negative side of voltage divider. Open negative side of potentiometer.	High system voltage	Defective resistor or potentiometer.
Open resistor in positive side of voltage divider. Open positive side of potentiometer.	No Charge	Defective resistor or potentiometer.
Open collector load resistor.	No Charge.	Defective resistor.
Open drive emitter base resistor.	Poor switching which will short output transistor. High system voltage.	Defective resistor. Reversed field and positive regulator leads.

SPEEDOMETER TROUBLESHOOTING

Malfunction	Probable Cause	Remedy
Pointer will not move from zero.	Transmission speed adapter or its drive key broken.	Repair or replace adapter. Replace drive key.
	Flexible shaft connecting transmission and sender broken.	Replace cable or cable casing assy.
	Sender not properly grounded.	Check ground strap being sure to clean off any paint or rust at connections.
	Open or shorted battery line to sender.	Repair or replace battery lead to sender.
	Sender resistor ring dirty.	Clean with solvent or replace.
	Sender brushes worn or hung-up.	Replace brushes or free brushes in slots.
	Sender rotor worn, dirty or broken.	Clean rotor with cloth, dress commutator with find sandpaper or replace rotor.
	Four wiredead broken between sender and receiver.	Check operation on vehicle with test lamp. Replace or repair lead is at fault.
	Open circuit in receiver field coils.	Test for continuity. Replace complete coil set if one or both coils are defective.
	Magnet and rotor ball bearings tight.	Replace bearings - it is impractical to clean and lubricate them as bearings contain special grease.
	Any speedometer failure which would tend to jam the mechanism.	Repair speedometer portion of unit.
Pointer wavers or moves erratically.	Lack of speed cup spindle end play.	Correct end play by pushing 1st gear shaft toward speed cup and adjust speed cup spindle end play to .006" - .010".
	Broken or weak speed cup hair spring.	Replace speed cup.
	Dirt or grease on magnet or speed cup.	Clean speed cup and magnet with cloth.
	Dirty or worn speed cup spindle jewel in magnet.	Clean jewel with piece of soft wood or replace megnet and shaft.
	Speed cup spindle corroded or bent.	Replace speed cup.

SPEEDOMETER TROUBLESHOOTING (Cont'd)

Inadequate zero bank - (Pointer does not return to zero.)	Weak, broken or improperly adjusted hair spring.	Adjust hair spring or replace speed cup.
	Pointer improperly set.	Remove Pointer and reset at zero mark on face dial.
Incorrect speed indication.	Dirty receiving unit.	Disassemble and clean.
	Dirty or grease filled sending unit.	Disassemble & clean. If grease filled, inspect & replace seal in sender. Also, check for grease in flexible shaft which may be due to defective grease seal at transmission.
Inoperative odometer.	Gears stripped.	Replace gears.
	Excessive end play in second gear.	Adjust to .010" to .015" end play.
	Defective wheels or stripped star pinions.	Replace wheels and star pinions or complete odometer.
	Incorrect odometer end play.	Measure end play at odometer hubs. Should be .009" to .018" for die cast wheels or .012" to .021 " for plastic wheels.
Receiving unit operates backwards	Four wire cable incorrectly wired to connectors.	Reverse any two diagonal leads only at one connector.

LIGHT BULB DATA

(Effective Unit No. 10001 thru 10726)

All bulbs used in the coach are 24 - volt. Do not attempt to replace with 12 - volt components.

EXTERIOR LIGHTS	NUMBER	CANDLE POWER OR WATTAGE	QTY. PER BUS
Fog Lights (Clear Sealed Beam)	4880	60W	2
Fog Lights (Amber Bulb Type)	1271	60W	2
Headlights - Inner	4619	50W	2
Headlights - Outer	4624	50/50W	2
Turn Signal Lights	1665	21	4
Side Turn Signal Lights	308	21	2
Stop Lights	1665	21	2
Destination Sign Lights	1691 IF	15	5
Tail Lights	623	6	2
Rear License Plate Lights	623	6	2
Center Marker Lights	1251	3	6

LIGHT BULB DATA (Cont'd)

(Effective Unit No. 10001 thru 10726)

EXTERIOR LIGHTS	NUMBER	CANDLE POWER OR WATTAGE	QTY. PER BUS
Corner Marker Lights	1251	3	4
Back-Up Light (Sealed Beam)	4578	60W	1
Side Approach Marker Lights	1252	3	2
INTERIOR LIGHTS			
In-Station 115V - Ceiling - Fluorescent	F15T8	15W	24
In-Station 115V - Baggage - Slantline 33	25T8	25W	6
Lavatory Main Light	1638	32	1
Lavatory Night Light	1495	6	1
Reading Lights	1691 IF	15	44
Driver's Light	1665	21	1
Indirect Lights	1691 IF	15	20
Aisle Lights	1251 CB	6	6
Instrument Panel Lights	313	3.5	3
Tachograph Lights	15617		2
Step Light	623	6	1
Baggage Compt. Lights	308	21	6
Engine Compt. Lights	623	6	2
Running Lights	1251	3	2
Lavatory Stepwell	1450	.23	2
TELL-TALE LIGHTS			
Heat On	1450	.23	1
Air Conditioning	313	3.5	1
Low Oil	313	3.5	1
Not Generating	313	3.5	1
Emergency Brake	313	3.5	1
Lavatory Emergency	313	3.5	1
Low Air	313	3.5	1
Hot Engine	313	3.5	1
Back-Up Light	313	3.5	1
High Beam	313	3.5	1
I.C.C. Flasher	1450	.23	1
Fog Light	1450	.23	1
Stop Light	1450	.23	1
Turn Light	1450	.23	1
Gen. Discharge - Remote Control Panel	313	3.5	1
Lavatory "Occupied" Sign	1450	.23	2
Blower Door Warning	313	3.5	1

LIGHT BULB DATA (CONT'D)

(Effective Unit No. 10727)

EXTERIOR LIGHTS	NUMBER	CANDLE POWER OR WATTAGE	COLOR CAP.	QTY.
Fog Lights (Clear Sealed Beam)	4880	60W		2
Fog Lights (Amber Bulb Type)	1271	60W		2
Headlights - Inner	4619	50W		2
Headlights - Outer	4624	50/50W		2
Turn Signal Lights	1203	21		4
Stop Lights	1683	21		2
Side Turn Signal Lights	1638	21		2
Destination Sign Lights	1691 IF	15		5
Tail Lights	623	6		2
Rear License Plate Lights	624	6		2
Center Identification Lights	1251	3		6
Roof Corner Clearance Lights	1251	3		4
Back-Up Light (Sealed Beam)	4578	60W		1
Side Approach Marker Lights	1252	3		2
INTERIOR LIGHTS				
In-Station 115V - Ceiling - Fluorescent	F15T8	15W		24
In-Station 115V - Baggage - Slantline 33	25T8	25W		6
Lavatory Main Light	1638 OF	32		1
Lavatory Night Light	1495	6		1
Reading Lights	1691 IF	15		44
Driver's Light	1203	21		1
Indirect Lights	1691 IF	15		22
Aisle Lights	1251 CB	6	Blue	6
*Instrument Panel Lights	1450 IF	3.5	Green	3
**Instrument Panel Lights	757	.62	Green	3
Driver's Switch Panel Lights	1450 IF	3.5	Green	10
Tachograph Lights (Argo)	15617	.6		2
Tachograph Lights (Sangamo)	193	2		2
Step Light	624	6		1
Baggage Compt. Lights	308 IF	21		6
Engine Compt. Lights	623	6		2
Running Lights	1251 CB	3	Blue	2
Lavatory Step Well	1450	.23		2
Lavatory "Watch Your Step" Sign	1450	.23		2
TELL-TALE LIGHTS				
Heat On	1450 IF	.23	Green	1
Air Conditioning	356 IF	3.5	Red	1
Low Oil	356 IF	3.5	Red	1
Not Generating	1450 IF	3.5	Amber	1

* Effective Unit No. 10727 thru 12492

** Effective Unit No. 12493 thru 12550

LIGHT BULB DATA (Cont'd)

(Effective Unit No. 10727)

TELL-TALE LIGHTS (Cont'd)	NUMBER	CANDLE POWER OR WATTAGE	COLOR CAP.	QTY.
Emergency Brake	356 IF	3.5	Red	1
Lavatory Emergency	1450 IF	3.5	Red	1
Low Air	356 IF	3.5	Red	1
Hot Engine	356 IF	3.5	Red	1
Back-up Light	356 IF	3.5	Green	1
High Beam	1450 IF	3.5	Blue	1
I.C.C. Flasher	1450 IF	.23	Red	1
Fog Light	1450	.23	Blue	1
Stop Light	1450 IF	.23	Amber	1
Turn Light	1450 IF	.23	Green	1
Gen. Discharge - Remote Control Panel	356 IF	3.5		1
Lavatory "Occupied" Sign	1450	.23		2
Blower Door Warning	356 IF	3.5	Red	1
Trailing Axle	1450 IF	3.5	Red	1
Low Water Level	1450 IF	3.5	Red	1
Low Fuel Level	1450 IF	3.5	Amber	1
Fire Alarm	1450 IF	3.5	Red	1

FRONT JUNCTION BOX CONNECTIONS

Stud	Code	Color	GA.	Component
1	26	Orange-Black	16	Oil Pressure Gauge
2	27	Brown	16	Temperature Gauge
3	42VCH	Blue	18	VCH Potentiometer Rotor
4	29	Red-Black	14	Engine Start Switch
5	41	Black-Red	16	Horn Relay
6	44F	Yellow	16	Turn Light - Left Front
7	44R	Yellow	16	Turn Light - Left Rear & Side
8	45F	Yellow-Red	16	Turn Light - Right Front
9	45R	Yellow-Red	16	Turn Light - Right Rear & Side
10	25	Grey	14	Emergency Engine Stop
11	5	White-Red Xtr.	18	24V Discharge Tell-tale
12	6	Blue-Yellow	16	Engine Stop - Engine Guard
13	38	White-Green	18	Low Air Tell-Tale
14	3	Black	10	Load Side of Master Switch
14	3	Black	14	Instrument Feeder
14	3	Black	10	Circuit Breaker Buss Bar - Feeder
15	15	Red-Blue	14	Marker Lights
15	15	Red	12	Marker Lights Feeder (Load Side)
16	21	Red-Blue	16	Running Lights
16	21	Blue-White	16	Aisle Lights
16	43	Green-White	16	Dash Lights
17 N.C.	69	Red-Blue	16	N.C.
18	47	Red-Yellow	14	Evap. Motor Relay Feeder
19	24P	Green-Yellow	16	Stop Lights Feeder
19	9P	Black-Yellow	16	Ent. Door Lock
20	24	Green-Yellow	16	Stop Lights
21	28	Brown-Yellow	16	Lavatory Alarm
22	65	White-Brown	16	Reverse Solenoid Relay
23	22	Black-Yellow	16	Driver's Light
24	20	Yellow	12	Indirect Light Feeder
24	20	White-Red(2 Wires)	14	Indirect Lights
25	31	Green-Black	14	Baggage Compartment Lights
26	39P	Red-White	16	Emergency Brake TT & Fast Idle
26	24P	Green-Yellow	18	Door Lock Feeder
26	3	Black	16	Master Circuit - Emerg. Brake Sw. & Fast Idle
26	3	Black	16	Master Circuit (Load Side) - Emerg. Brake Sw. & Fast Idle
27	35	White-Black	16	High Beam Tell-tale
28	33	Red-Black	12	Spare
29	63A	Maroon	14	Spare
30	54	Yellow	14	Heating, Air Cond. Feeder

FRONT JUNCTION BOX CONNECTIONS (Cont'd)

Stud	Code	Color	GA.	Component
31	55	Orange	16	Sensing Element "C"
32	50	Green-Red	16	Fire Detector
33	7R	Black-White	14	Right-Hand Reading Lights
34	67	Maroon	18	Low Pressure A/C Tell-tale & Buzzer
35	53	Black-Blue	16	Fuel Gauge (Optional) or T-N-L Sensor
36	11	Red-Yellow	16	Stop Light Tell-tale
37	76	White-Green	16	Driver's A/C Freon Valve
38	30	Brown-White	16	Alarmstat or T-N-L Sensor
39	32	Orange-Green	16	Spare
40	18	Black-White	16	Spare
41	46	Blue	16	Back-Up Light Tell-tale Return
42	16	Black	16	Sensing Element A & Potentiometer
43	56	Green	16	Hot Water Valve
44	37	White-Red	16	Step Light
45	7L	Maroon	14	L.H. Reading Lights
46	40	Grey	16	Fast Idle - Load Side
47	40P	Grey	16	Fast Idle - Line Side
47	39T	Red-White	16	Emerg. Brake TT & Fast Idle
48	59	Yellow-Black	16	Jacobs Engine Brake or Allison Temperature Sender
49	66	Orange-White	16	Evaporator Motor Low Speed
50	60	Yellow	18	3-lb. Oil Switch - Std.
51	10	Black-Red	18	T-N-Level Water Sensor
52	52	Brown-Black	16	Fog Light Tell-tale
53	9	Black-Green	18	Door Latch Skinner Valve
54	58	Blue	18	Graham White Valve(Load Side Switch)
55	23	White-Green	16	12 Volt-Option
55		Black	19	12 Volt-Option
56	61	Orange-Red	16	Spare
57	57	Yellow-Green	16	Air Cond. Control Feeder
57	68	Red	16	2 HP Motor - Relay Feeder
A	18A	Black-White	18	Blower Door Tell-tale
B	B	Green-White	18	Lo-Air Trailing Axle Tell-tale
C	C	White-Black	18	Electric Tachometer - Optional
D		Brown-White	18	Tachometer
WH		White	18	Speedometer
BR		Brown	18	Speedometer
GR		Green	18	N.C.
BL		Black	18	Speedometer

REMOTE CONTROL BOX (VERTICAL BAR) (Cont'd)

Stud	Code	Color	GA.	Component
2	15	Red-Blue P.S.	16	Tail Lights
3	24	Green-Yellow-Yellow P.S.	16	Stop Lights
4	31	Green-Black P.S.	16	Motor Compt. Service Lights
5	45	Yellow-Red P.S.	16	R.H. Turn Light
6	57	Yellow-Green-Green P.S.	16	Compressor Solenoid Valve
7	63	Blue-Blue P.S.	16	Lavatory Blower
8	63A	Red-Blue-Blue	16	Lavatory Pump

SPECIFICATIONS

GENERATOR

Make	Delco-Remy
Model Number	1117675
Field Current @ 80° F	
Amperes	5.6-6.3 amps
Volts	24 volts
Field Resistance at 80° F	3.8-4.3 ohms
Hot Output	
Amperes	225 at 80° F ambient
Volts	28
Approximate RPM	3000
Ground	Negative

REGULATOR (24 - VOLT)

Make	Delco Remy
Type	Transistor
Voltage Adjustment	External Screw

BATTERIES (24 - VOLT SYSTEM)

No.	2
SAE No.	8D
No. Plates / Cell	25
Amp. Hr. Rating	205
Grounded Terminal	Negative

STARTER MOTOR

Make	Delco Remy
Model	1113952
Rotation (Viewing D.E.)	CW
Brush Tension	5 lb. Min.
Voltage	24

AIR CONDITIONING JUNCTION BOX

Stud	Code	Color	GA.	Component
1	14	White-Red	16	Spare
2	16	Black	16	Sensing Element A & Potentiometer
3	31	Green-Black	14	Baggage Compartment Lights
4	44	Yellow	16	L.H. Turn Lights
5	45	Yellow-Red	16	R.H. Turn Lights
6	23	White-Green	16	12 Volt Option
7	56 & 56A	Green	18	Hot Water Valve
8	55	Orange	16	Sensing Element "C"
9	21	Blue-White	14	Aisle Lights
10	66	Orange-White	16	1 HP Motor - Low Speed Control
11	68	Red	16	2 HP Motor - Relay Coil Feed
12	70P	Green-Yellow Xtr.	18	T-N-Level Fuel Heater
13	53	Black-Blue	16	Fuel Gauge (Optional) or Fuel Sensor
14	47	Red-Yellow	14	1 HP Motor - Relay Coil Feed
15	64	White-Red-Black Xtr.	18	A/C Safety Switch

REMOTE CONTROL BOX (HORIZONTAL BAR)

Stud	Code	Color	GA.	Component
1	14P	Green-Yellow P.S.	16	Hi-Lo Pressure Switch Feeder
1	57A	Orange-Orange P.S.	16	A/C Scavenger Solenoid
2	14H	Green-White P.S.	16	Hi-Lo Pressure Switch
3	14L	Yellow-Yellow P.S.	16	Low Pressure Switch
4	46	Orange-Red P.S.	16	Back-Up Light
5	44	Yellow P.S.	16	L.H. Turn Light
6	46G	Blue P.S.	16	Back-Up Light Return
7	24	Green-Yellow-Yellow P.S.	16	Stop Lights
8	15	Red-Blue P.S.	16	Tail Lights
9	6A	Blue-Yellow P.S.	16	Engine Stop Valve
10	40	Grey P.S.	16	Spare

REMOTE CONTROL BOX (VERTICAL BAR)

Stud	Code	Color	GA.	Component
1	17	Red-Black P.S.	16	License Plate Lights
2	15	Red-Blue P.S.	16	Marker Lights

SPECIFICATIONS (Cont'd)

STARTER MOTOR (Cont'd)

No-Load Test	
Volts	23V
Min. Current Draw	60 Amps.
Max. Current Draw	90 Amps.
Min. R.P.M.	7000 R.P.M.
Lock Test	
Current Draw	500 Amps.
Min. Torque	26 lb. ft.
Volts	3.5V
Brushing Diameters (I.D.)	
Commutator End Frame	.562-.564
Shift Lever Housing	.8335-.8355
Nose Housing	.624-.626

STARTER SOLENOID

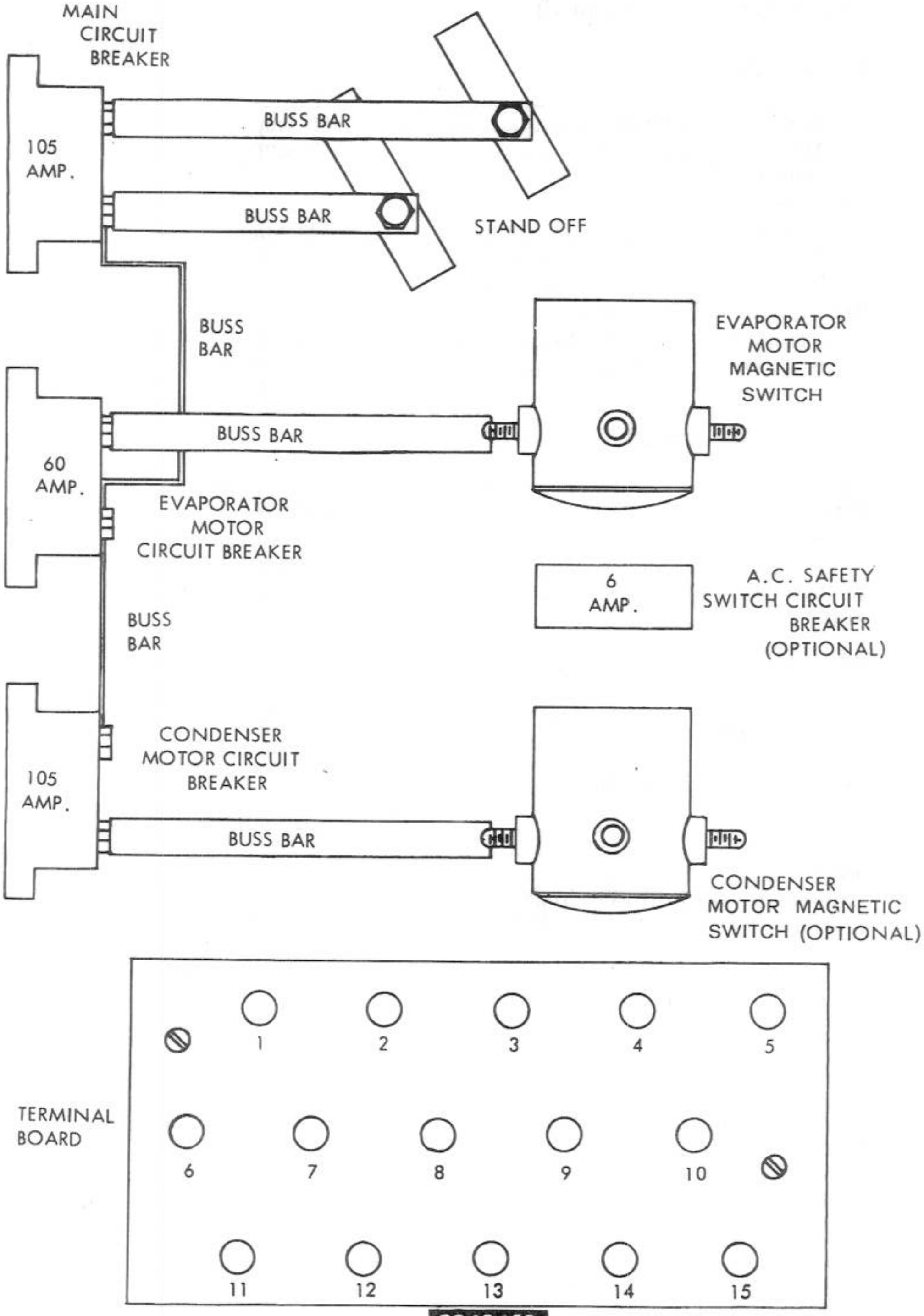
Make	Delco Remy
Model	1119832
Current Draw 80° F	
Hold-in Winding	7.35-8.2 Amps.
Pull-in Winding	48-54.5 Amps.
Volts	24

ALARMSTAT

Make	Kysor
Contact Points Close At	210° F.

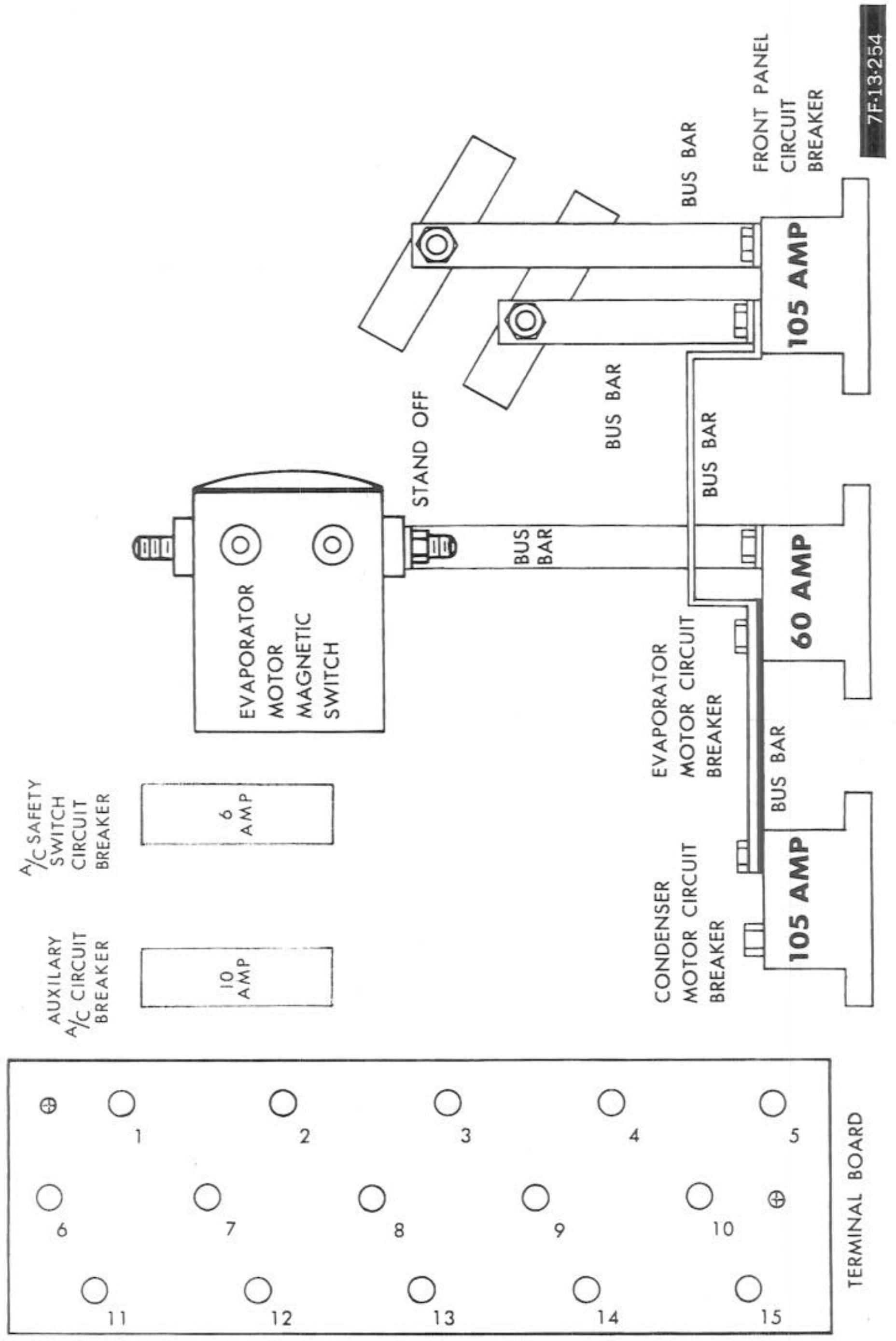
REVERSE SOLENOID

Make	Delco Remy
Model	1119911
Volts	24V
Current Draw—Both Windings	23-28.6 Amps.
Current Draw—Hold-in Winding	7-8.6 Amps.

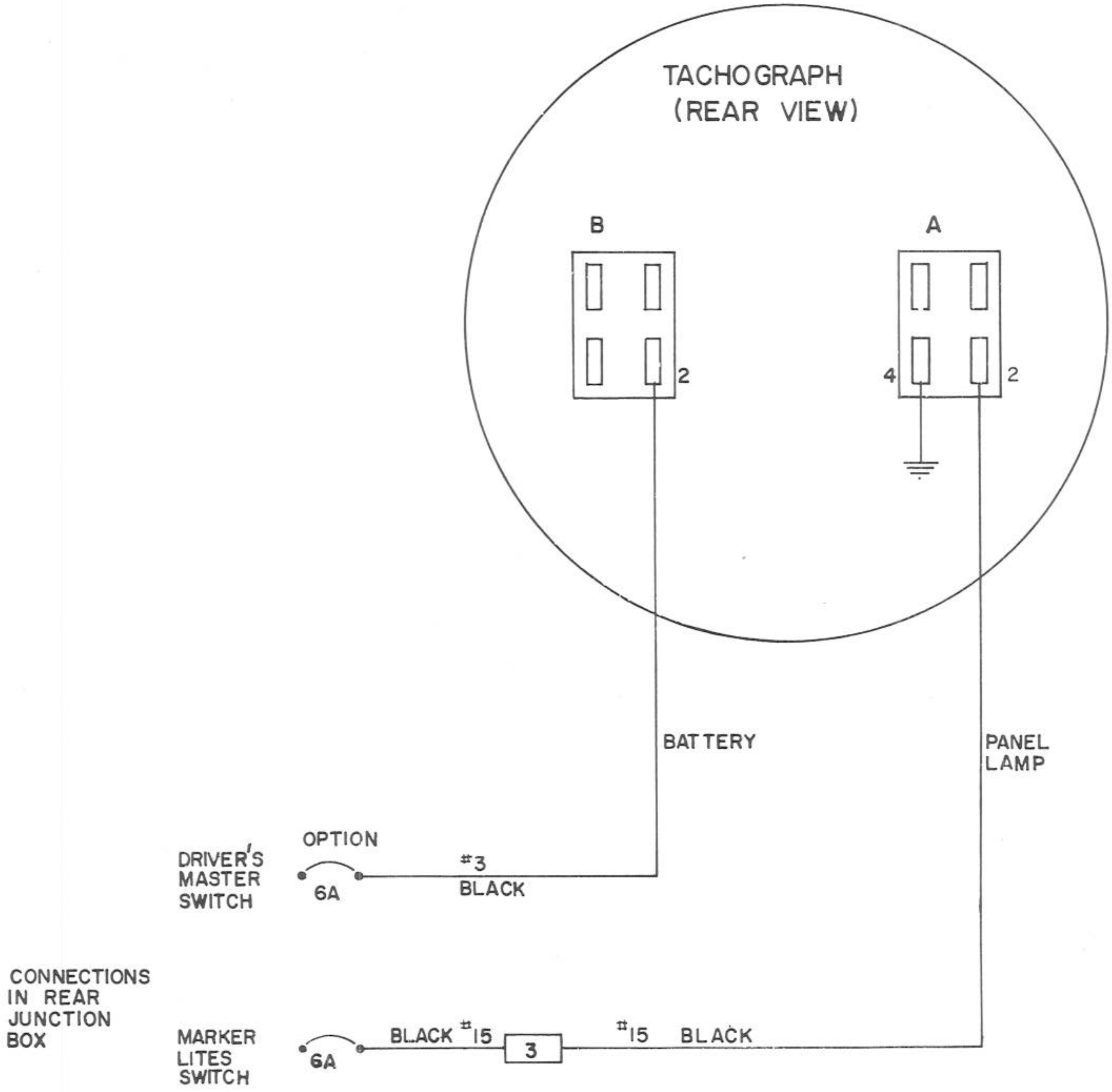

MAIN
CIRCUIT
BREAKER
105
AMP.
BUSS BAR
BUSS BAR
STAND OFF
BUSS
BAR
EVAPORATOR
MOTOR
MAGNETIC
SWITCH
60
AMP.
BUSS BAR
EVAPORATOR
MOTOR
CIRCUIT BREAKER
6
AMP.
A.C. SAFETY
SWITCH CIRCUIT
BREAKER
(OPTIONAL)
BUSS
BAR
CONDENSER
MOTOR CIRCUIT
BREAKER
105
AMP.
BUSS BAR
CONDENSER
MOTOR MAGNETIC
SWITCH (OPTIONAL)
TERMINAL
BOARD
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

7C-13-168

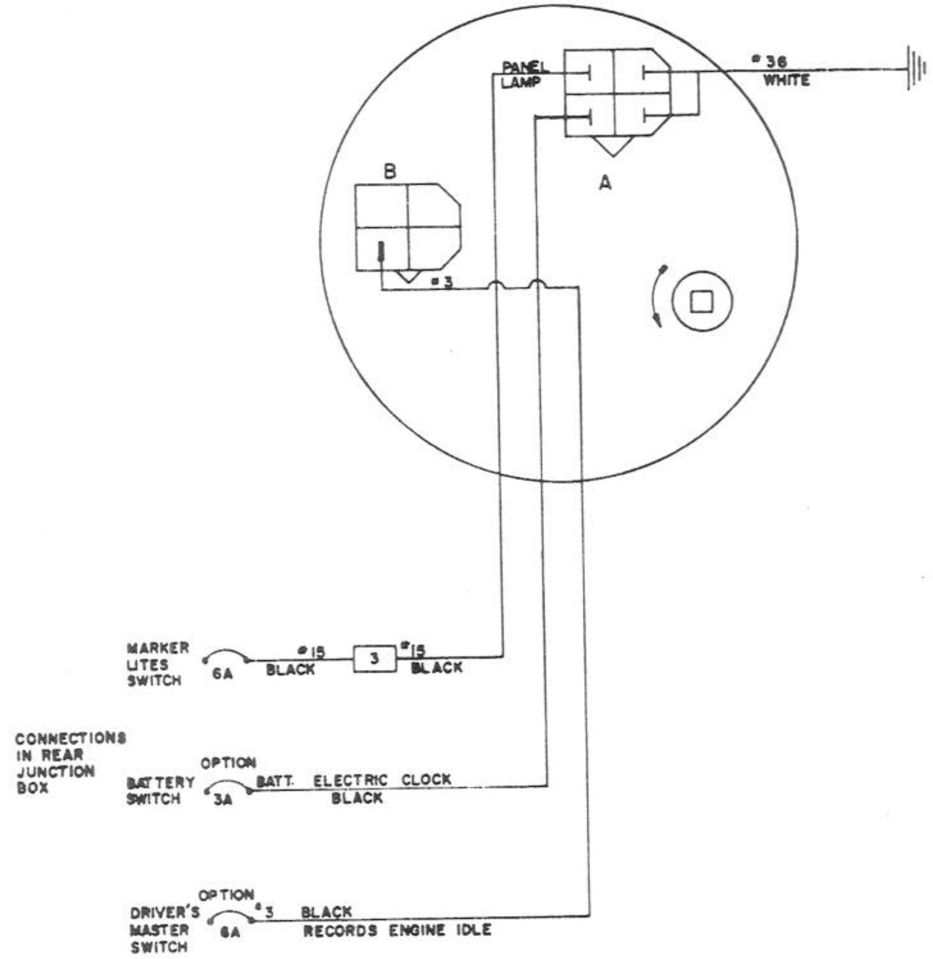
EFFECTIVE UNIT NO. 10001 thru 12400


AUXILARY A/C CIRCUIT BREAKER
10 AMP
A/C SAFETY SWITCH CIRCUIT BREAKER
6 AMP
EVAPORATOR MOTOR MAGNETIC SWITCH
STAND OFF
BUS BAR
BUS BAR
BUS BAR
BUS BAR
BUS BAR
CONDENSER MOTOR CIRCUIT BREAKER
EVAPORATOR MOTOR CIRCUIT BREAKER
FRONT PANEL CIRCUIT BREAKER
105 AMP
60 AMP
105 AMP
7F-13-254
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
TERMINAL BOARD

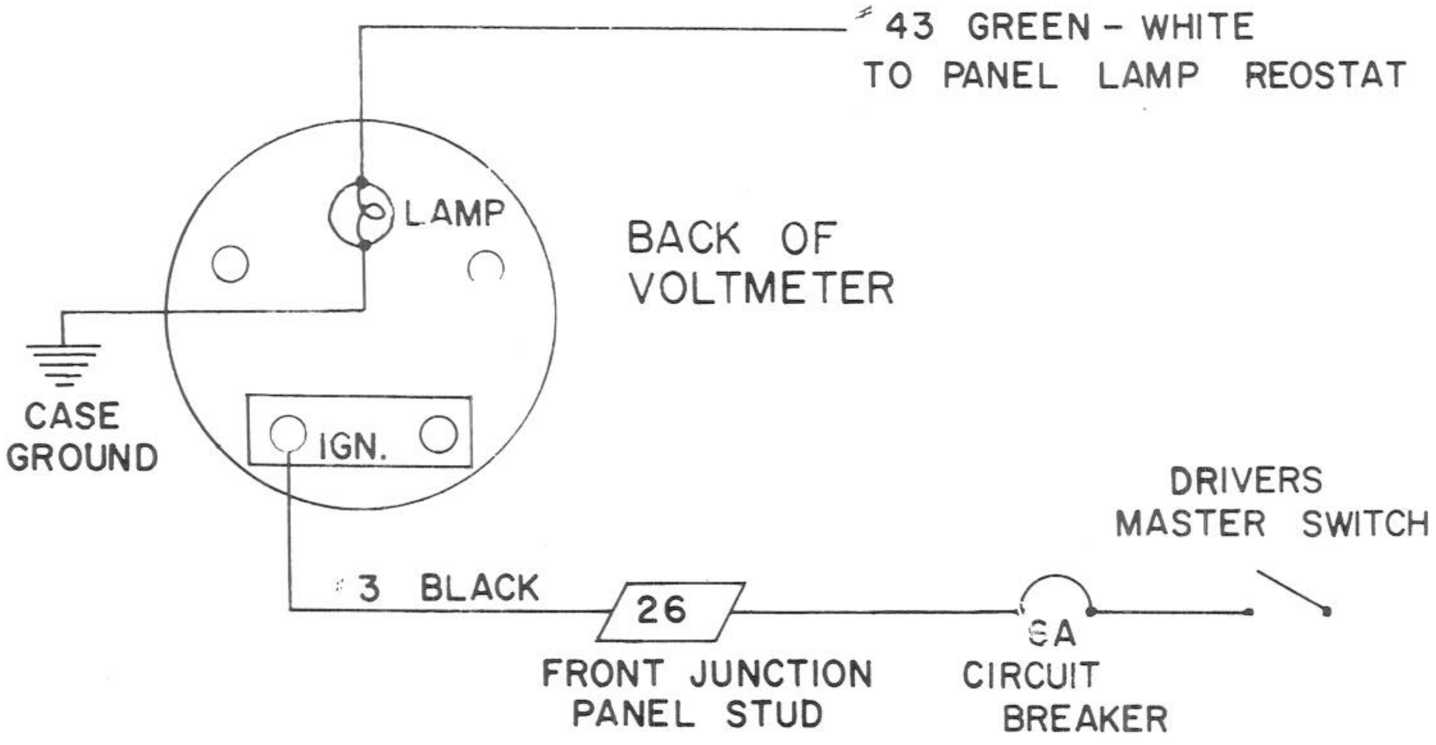
EFFECTIVE UNIT NO. 12400 thru 12550


TACHOGRAPH
(REAR VIEW)
B
A
2
4
2
BATTERY
PANEL LAMP
OPTION
DRIVER'S MASTER SWITCH
6A
#3
BLACK
CONNECTIONS IN REAR JUNCTION BOX
MARKER LITES SWITCH
6A
BLACK #15
3
#15 BLACK

OPTIONAL - TACHOGRAPH WITH MECHANICAL CLOCK
MODEL - MC - 7
UNIT NO. 10001 thru 11970
DATE: SEPT., 1968

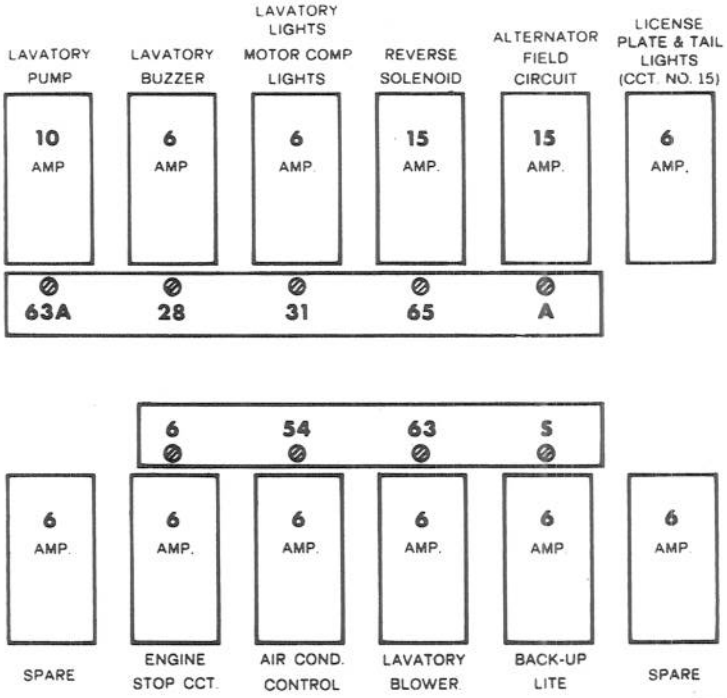

PANEL LAMP
#36 WHITE
A
B
#3
MARKER LITES SWITCH
6A
#15 BLACK
3
#15 BLACK
CONNECTIONS IN REAR JUNCTION BOX
OPTION
BATTERY SWITCH
3A
BATT. ELECTRIC CLOCK
BLACK
OPTION
DRIVER'S MASTER SWITCH
6A
#3 BLACK
RECORDS ENGINE IDLE

OPTIONAL-TACHOGRAPH WITH ELECTRIC CLOCK
MODEL MC-7 (ARGO)
UNIT NO. 11971-
DATE: AUGUST 1974



#43 GREEN - WHITE
TO PANEL LAMP REOSTAT
LAMP
BACK OF VOLTMETER
CASE GROUND
IGN.
DRIVERS MASTER SWITCH
#3 BLACK
26
8A
FRONT JUNCTION PANEL STUD
CIRCUIT BREAKER

VOLTMETER INSTALLATION
(24-VOLT - NEGATIVE GROUND)
MODEL MC - 7
EFFECTIVE UNIT NO 10,001
DATE: AUGUST 1974

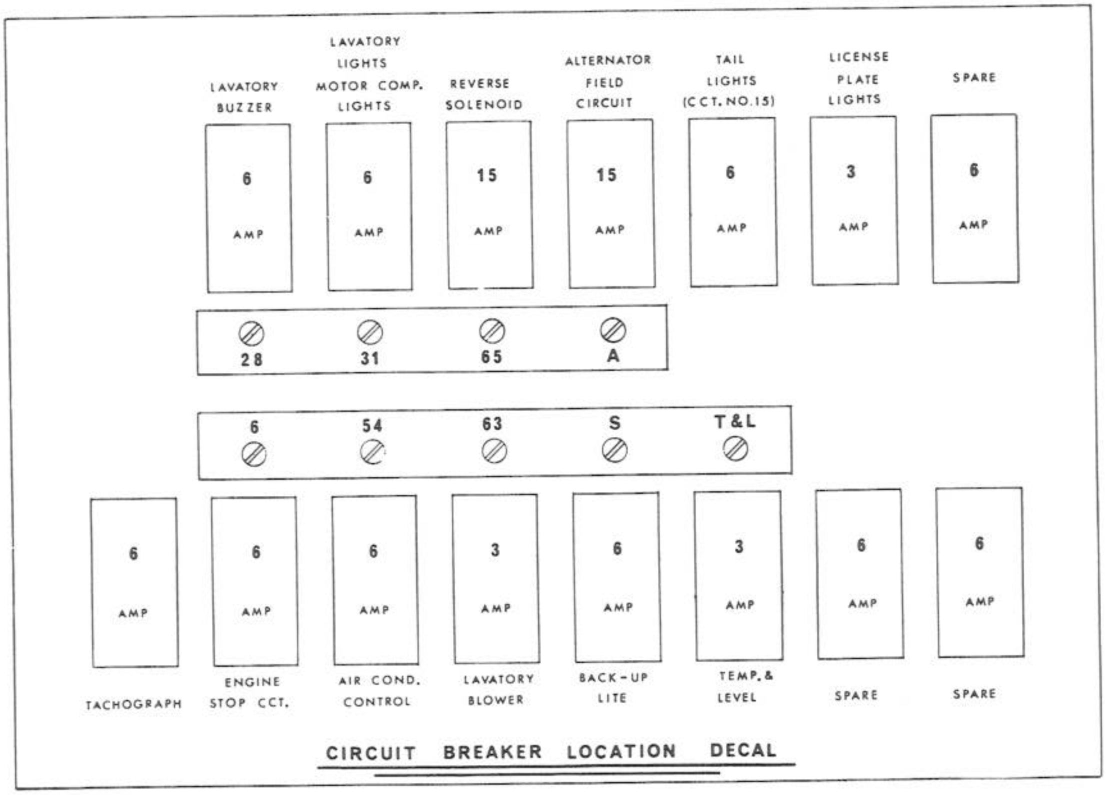

LAVATORY PUMP
10 AMP
LAVATORY BUZZER
6 AMP
LAVATORY LIGHTS
MOTOR COMP LIGHTS
6 AMP.
REVERSE SOLENOID
15 AMP.
ALTERNATOR FIELD CIRCUIT
15 AMP.
LICENSE PLATE & TAIL LIGHTS (CCT. NO. 15)
6 AMP.
63A
28
31
65
A
6
54
63
S
6 AMP.
SPARE
6 AMP.
ENGINE STOP CCT.
6 AMP.
AIR COND. CONTROL
6 AMP.
LAVATORY BLOWER
6 AMP
BACK-UP LITE
6 AMP
SPARE

CIRCUIT BREAKER LOCATION DECAL

7F 13 5

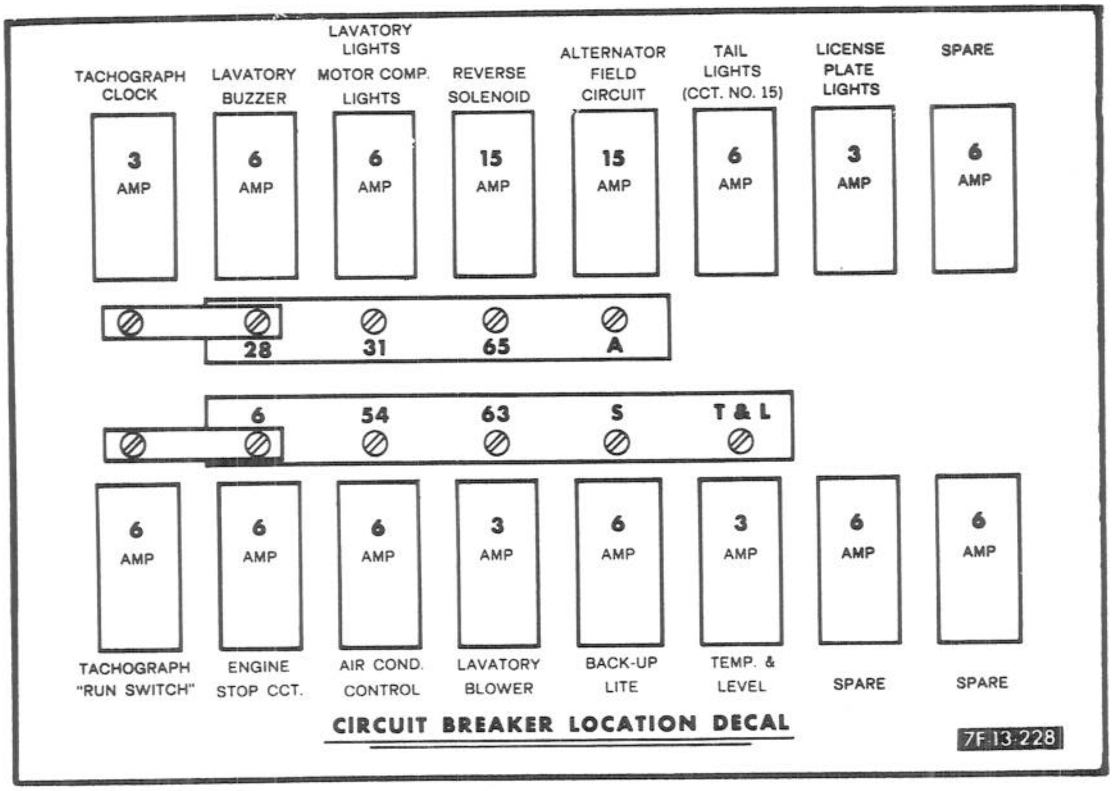
DATE: DECEMBER 29, 1967

EFFECTIVE UNIT NO. 10001 to 10151


LAVATORY BUZZER
6 AMP
LAVATORY LIGHTS MOTOR COMP. LIGHTS
6 AMP
REVERSE SOLENOID
15 AMP
ALTERNATOR FIELD CIRCUIT
15 AMP
TAIL LIGHTS (CCT. NO. 15)
6 AMP
LICENSE PLATE LIGHTS
3 AMP
SPARE
6 AMP
28
31
65
A
6
54
63
S
T&L
6 AMP
TACHOGRAPH
6 AMP
ENGINE STOP CCT.
6 AMP
AIR COND. CONTROL
3 AMP
LAVATORY BLOWER
6 AMP
BACK-UP LITE
3 AMP
TEMP. & LEVEL
6 AMP
SPARE
6 AMP
SPARE
CIRCUIT BREAKER LOCATION DECAL

CIRCUIT BREAKER LOCATION DECAL

Part No. 7F-13-122
Model - MC-7
Effective Unit No. 10151 thru 11450
Date: August, 1974


TACHOGRAPH CLOCK
3 AMP
LAVATORY BUZZER
6 AMP
LAVATORY LIGHTS MOTOR COMP. LIGHTS
6 AMP
REVERSE SOLENOID
15 AMP
ALTERNATOR FIELD CIRCUIT
15 AMP
TAIL LIGHTS (CCT. NO. 15)
6 AMP
LICENSE PLATE LIGHTS
3 AMP
SPARE
6 AMP
28
31
65
A
6
54
63
S
T & L
6 AMP
TACHOGRAPH "RUN SWITCH"
6 AMP
ENGINE STOP CCT.
6 AMP
AIR COND. CONTROL
3 AMP
LAVATORY BLOWER
6 AMP
BACK-UP LITE
3 AMP
TEMP. & LEVEL
6 AMP
SPARE
6 AMP
SPARE
CIRCUIT BREAKER LOCATION DECAL
7F 13-228

CIRCUIT BREAKER LOCATION DECAL

Part No. 7F-13-228
Model - MC-7
Effective Unit No. 11451 thru 12550
Date: August, 1974

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

ENGINE

DESCRIPTION

The engine is a General Motors 8V-71N two-cycle diesel. Bore and stroke is 4-1/4x5 ins. Piston displacement is 567.5 cu. in. Rated full-load speed is 2100 r.p.m.

Maintenance and repair information on the engine will be found in the current engine manufacturer's maintenance manual. Engine controls, accessories and related components are covered in the applicable sections of this manual.

Refer to Section 6 (Cooling), 7 (Electrical), 9 (Fuel), and 10 (Lubrication).

PARTS IDENTIFICATION

To conform with engine manufacturer's practice, MCI Parts Books, Maintenance Manuals, Service Bulletins and other technical publications identify all engine parts as "L.H.", "R.H.", "Front" or "Rear" when viewing the flywheel. This is opposite to the position of these parts with the engine installed in the coach, but the engine manufacturer's designations have been retained to eliminate potential misunderstanding in engine parts identification.

All other parts of the coach are designed "L.H.", "R.H.", "Front" or "Rear" in relation to the normal position of the driver in the driver's seat.

REMOVAL AND REPLACEMENT

The engine unit, including transmission, clutch, air compressor and alternators may be removed from the coach as a unit for access to engine or related components.

To facilitate removal and replacement of the engine unit and to provide a convenient means of supporting the engine and related components during service work, the use of a dolly is recommended. Such a dolly may be made locally.

The coach should be driven onto a twin-rail hoist and blocks placed between axle bumpers and bumper stops. Disconnect height control valve links and pull down to exhaust air from rear suspension bellows.

Drain the engine cooling system as directed in Section 6 (Cooling) of this manual, remove the cooling blower drive belt.

Open drain cock and exhaust air from the brake system. Disconnect the propeller shaft as outlined in Section 14 (Propeller Shaft) of this manual. Disconnect transmission and clutch operating linkage. Disconnect air line to clutch air assist mechanism. Disconnect throttle linkage.

Disconnect exhaust muffler slip joint. Disconnect air lines to air compressor governor and fast idle air cylinder.

Disconnect electrical connection to speedometer sending unit, starting motor, starting motor solenoid, alternator, engine controls, tachometer (If used), oil pressure and engine temperature sending units.

Disconnect and remove cooling system connections to radiators, surge tank and coach heating system. Disconnect fuel supply and return lines. Remove connections between air cleaner and engine air inlet horn. Remove rear bumper and tie bar.

If the coach is equipped with an air conditioning system, remove air conditioning compressor drive belts. Raise the coach approximately 4 - 6 inches above road height.

Remove the clamp bolts securing the engine sub-frame to the coach body. Position the dolly under the engine sub-frame. Lower the coach body only sufficiently to transfer the weight of the engine onto the dolly.

CAUTION: Due to the minimum clearance between the air compressor and the top of the engine compartment, extreme care should be used to lower the coach body only enough to free the engine sub-frame. Clearance between engine sub-frame and coach engine mounting rail should be 1/8 - 1/4".

Remove engine assembly as a unit, carefully withdrawing it from the rear of the coach.

To re-install, the procedure is the reverse of the above.

Refill cooling system. If engine fuel system has been drained, it will aid re-starting if fuel filters are filled with fuel oil. Remove vent plugs and pour fuel oil into filter body until filters are full.

Start engine and check operation. Check fuel and cooling system connections for leakage. Test operation of engine controls and accessories.

ENGINE OIL

For satisfactory performance and long engine life the quality of engine oil used for V-71 engines is very important.

The following specifications are recommended by the manufacturer.

8V-71 engines have given optimum performance and experience the longest service life with MIL-L-2104B, SAE 30 oils. However, the additive concentration of some MIL-L-2104B oils have been substantially increased in order to meet 1968-1969 MS performance requirements.

Some of these 1968-1969MS/MIL-L-2104B oils have given unsatisfactory performance because of excessive exhaust valve and ring-belt ash deposits. For these reasons primary lubricant recommendations are:

MIL-L-2104B and supplement 1 oils with the following limitations:

(1) Sulfated ash of 1.00% maximum by weight (A.S.T.M. D-874).
(2) Calcium content of 0.20% max. by weight.
(3) Zinc, as zince diorganodithiophosphate, between a minimum of 0.07 and a maximum of 0.10% by weight.

An SAE-30 oil is recommended for year-round use. The use of lower viscosity oils or multigrade products will usually result in less than normal engine life.

ENGINE MOUNTS

The engine is mounted to the engine cradle by means of five rubber mounts, two on each side of the flywheel housing and one at the front of the engine (to the rear of the coach).

It is suggested that these rubber mounts be installed whenever the engine is removed from the coach (i.e. clutch change, etc.)

Improper installation of the press fit type motor mounts can contribute to excessive engine vibration. When new mounts are installed, mount bolts should be left loose until engine can be run for a short period of time. If engine is accelerated a few times, the rubber mount will find its correct position and then mount bolts can be torqued and cotter key installed.

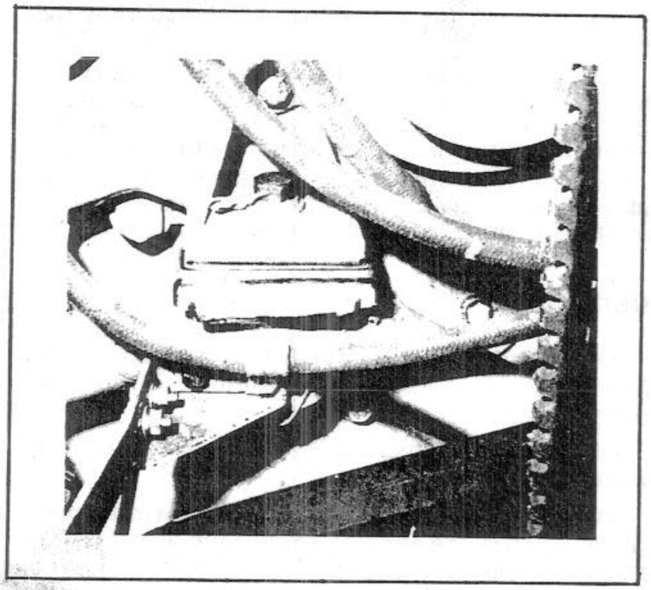


Fig. 8-1 Front Engine Mount

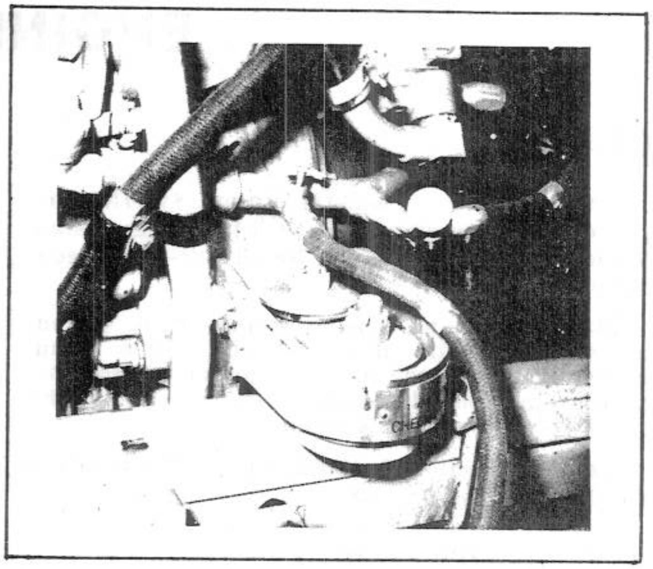


Fig. 8-2 L.H. Engine Mount

The following procedure is recommended for replacement of motor mounts:

Remove the existing rubber mounts from brackets.

Lubricate new rubber mounts with a rubber lubricant or liquid soap and place in position between bracket and cradle. By use of a small jack under the cradle, the mounts may be installed in engine bracket. NOTE: Before installing washer, remove all lubricant or soap from rubber mount in order to prevent a flaring of the rubber under the washer.

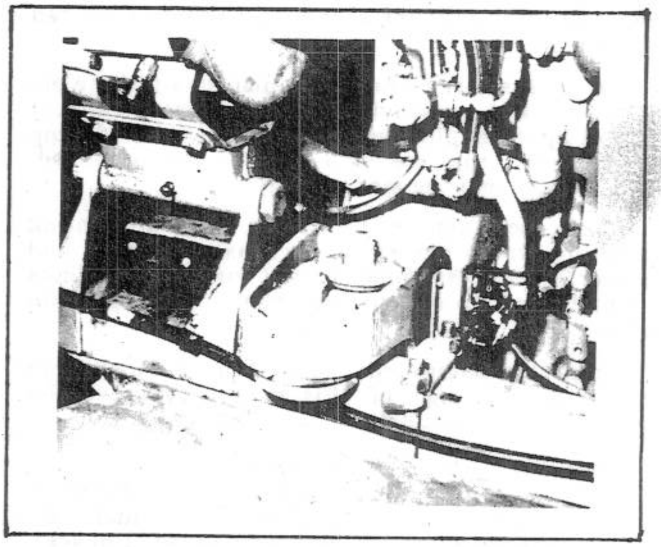


Fig. 8-3 R.H. Engine Mount

Install engine mount bolts with new retaining washer but DO NOT tighten until the full weight of engine is bearing on cradle assembly.

When re-installing the engine cradle assembly, the body tie bar should be installed before attempting to tighten craddle U-bolts. The center U-bolts should be tightened down first.

ALTERNATOR DRIVE PULLEY

DESCRIPTION

The alternator drive assembly is designed for four belts. It is factory balanced and machined.

The alternator drive pulley on engine should be assembled in the following manner to assure proper fitment.

PROCEDURE

(1) Install woodruff key into slot of accessory drive shaft making sure key is not loose. A snug fit is recommended.

(2) Install pulley and taper collar over accessory drive shaft with woodruff key fitted into slot portion of taper collar. Fasten pulley assembly with self-locking hex nut to accessory drive shaft. Torque to 180 ft. lbs.

(3) If a feeler gauge is available, check the tolerance between taper collar and woodruff key. It should read .003".

NOTE: Hex nut can be removed leaving pulley assembly on taper collar and woodruff key in pinched stage. This may be done if unable to enter gauge to taper collar and woodruff key.

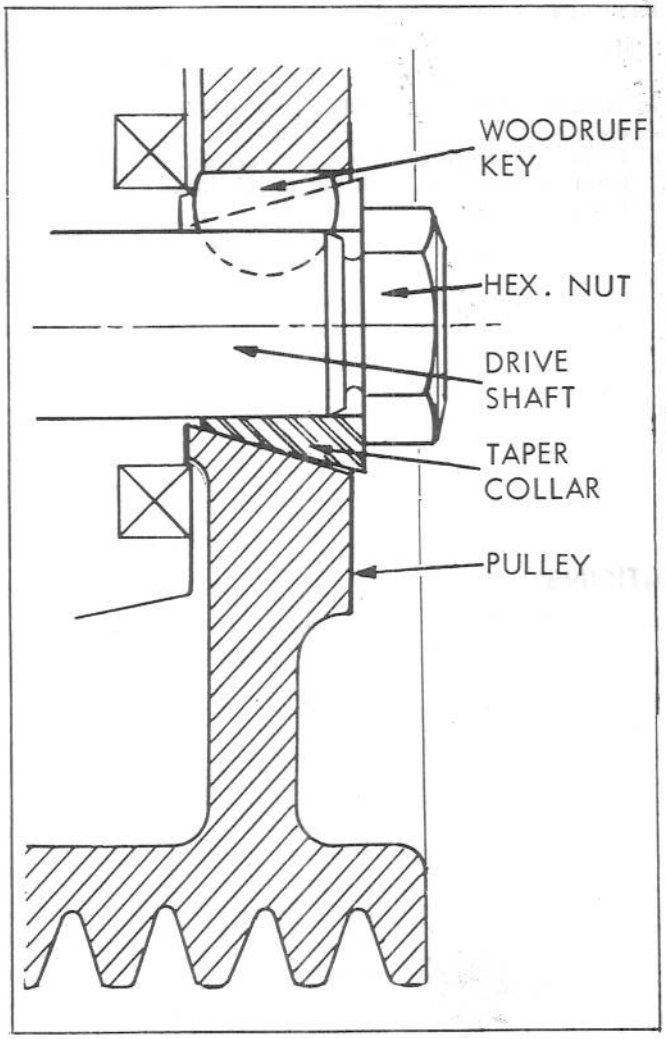
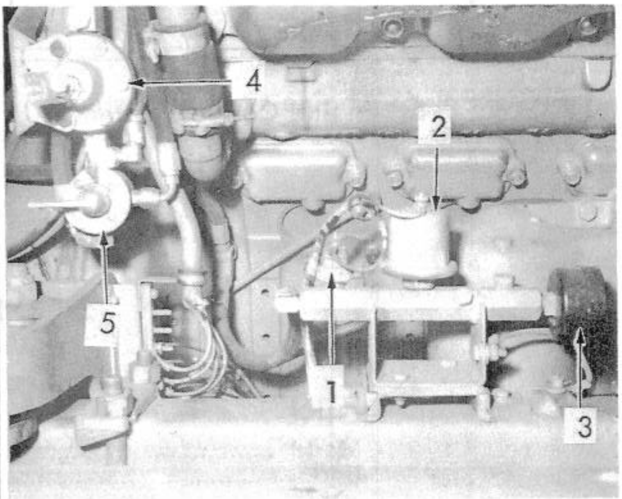


Fig. 8-4 Alternator Drive Pulley

SENDING UNIT MANIFOLD

The sending unit manifold is rubber mounted on the engine cradle to provide additional protection to sending units.

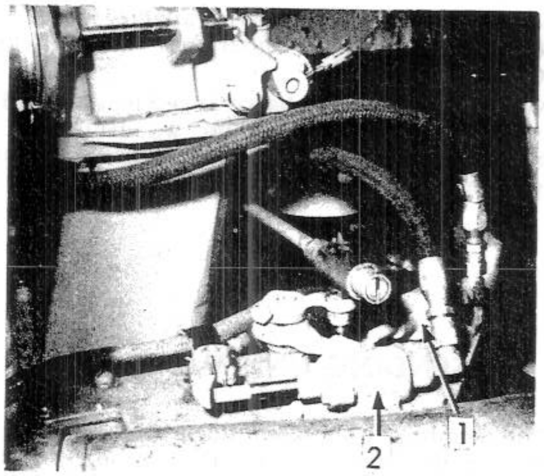


1. 3 lb. Oil Pressure Sending Unit
2. Oil Pressure Gauge Sending Unit
3. Manual Oil Pressure Gauge
4. Alternator pressure Regulating valve
5. Alternator air cylinder control valve

Fig. 8-5: Sending Unit Manifold

Shown in figure 8-5 is the manifold with the 3 lb. oil tell-tale sending unit, oil pressure gauge sending unit and the manual oil pressure gauge.

FAST IDLE OVERRULE AND ENGINE SHUT-DOWN VALVES AND AIR CYLINDERS



1. Fast Idle Overrule Air Cylinder
2. Engine Shut-down Air Cylinder

FIGURE 8-6: Engine Control System

REMOVAL

1. Disconnect air pressure lines from valves and cylinders.
2. Remove quick-disconnect plug from valves.
3. Remove stud nuts retaining valves to mounting bracket.

CAUTION: When removing air lines, loosen connections slowly to relieve excess air pressure.

DISASSEMBLY

1. Remove screws retaining cylinder to governor cover.
2. Remove cap from piston rod.
3. Pull piston and rod assembly out of cylinder.
4. Reverse for assembly.

INSTALLATION

1. Mount valves and air cylinders as Shown in Fig. 8-6
2. Install bellcranks and adjust to have 1/32" clearance with piston extended.
3. Install air supply lines, quick disconnect plugs, ground terminals and clip to left-hand cylinder head.

SPECIFICATIONS

ENGINE

Model	8V-71N
Bore	4-1/4"
Stroke	5"
Displacement (cu.in.)	567.5
Engine Rotation	Counterclockwise
Injector Timing Gauge	1,460"
Engine Crankcase Capacity	U.S. 28 qts. Imp. 22.4 qts.
Engine R.P.M. for approx. 65 M.P.H.	2050 (NO LOAD)

SPECIFICATIONS (Cont'd.)

ENGINE SHUT-DOWN

Solenoid Valve

Make	Skinner
Model	V5C45450
Voltage	24

Air Cylinder

Make	Schrader
Model	3351-A

FAST IDLE OVERRULE

Solenoid

Make	Skinner
Model	V5C45380
Voltage	24

Air Cylinder

Make	Schrader
Model	3351-A

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

FUEL SYSTEM

DIESEL FUEL OIL SPECIFICATIONS

For satisfactory performance and long engine life the quality of fuel used for high speed diesel engine operation is very important. The fuel must be clean, completely distilled, stable and non-corrosive. Distillation range, cetane number and sulfur content are the three most important properties in the selection of diesel fuels for optimum combustion and minimum wear. Engine speed, load and atmospheric temperature influence the selection of fuel distillation range and cetane number. The sulfur content must be as low as possible to avoid excessive deposit formation and premature wear.

Diesel fuels are generally marketed according to ASTM Designation D975-60T and only distillate fuels No. 1D and 2D are considered satisfactory for diesel engines. These fuels should not be confused with the domestic type furnace oils ASTM D396-60T which have similar properties but are not always satisfactory for engine use due to their varying composition, cetane number, and distillation range.

As a guide to the selection of the proper fuel oil for various applications refer to the fuel oil selection chart and the ASTM classification.

Engine operation at altitudes above 5000 feet requires use of next lighter class of fuel oil than would normally be used.

During cold weather engine operation, the "cloud point" (the temperature at which wax crystals begin to form in the fuel oil) should be 10°F. below the lowest expected fuel temperature to prevent clogging of the fuel filters by wax crystals.

FUEL SYSTEM

The fuel system consists of fuel tank, fuel lines, fuel filter, fuel strainer, fuel pump, fuel manifolds (integral in the cylinder head), fuel pipes (inlet and outlet), and injectors. A schematic diagram of fuel system components is shown in Figure 9 - 1.

For further information on engine fuel system components, refer to manufacturers diesel engine maintenance manual.

Fuel is drawn from the tank through the fuel

ASTM CLASSIFICATION OF DIESEL FUEL OILS

	No. 1-D	No. 2-D
Flash Pt., °F Min.	100	125
Carbon Residue; %	0.15	0.35
Water and Sediment; (% by Volume) Max.	Trace	0.10
Ash; % by Wt.; Max.	0.01	0.02
Distillation, °F 90% Pt.;		
Max.	550	640
Min.	-	540
Viscosity at 100°F; centistokes		
Min.	1.4	2.0
Max.	2.5	5.8
Sulfur; % Max.	0.5	0.7
Cetane No; Min.	40	40

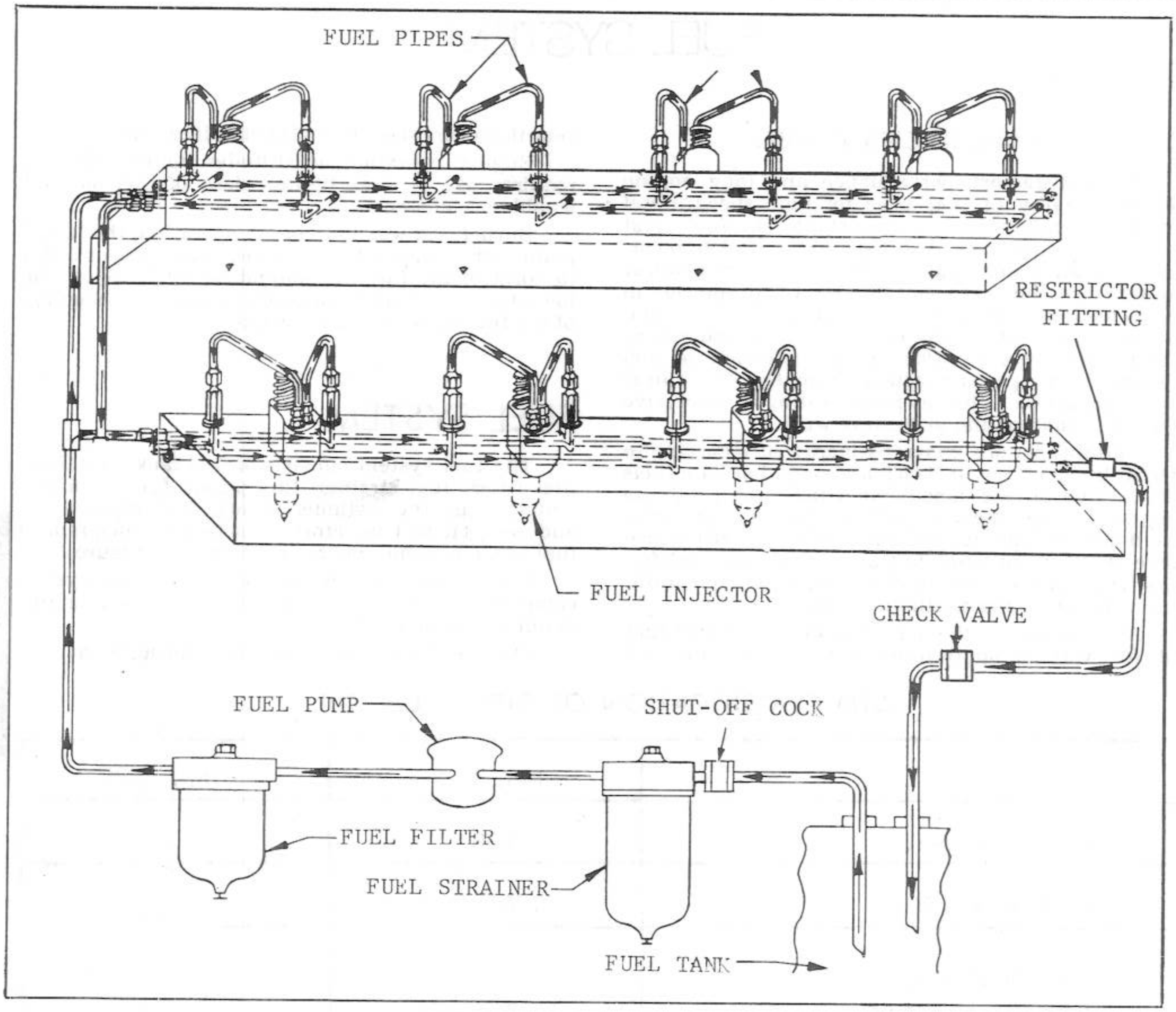


FIGURE 9 - 1: Fuel System

strainer and enters the fuel pump at the inlet side. Fuel is then forced through the fuel filter into the fuel manifold, then to the inlet side of the injectors. Surplus fuel returns from the outlet side of the injectors to outlet fuel pipes, into the return manifold and back to the fuel tank.

Engine speed is controlled through the governor, details of which will be found in the manufacturer's diesel engine manual.

The accelerator linkage connects the accelerator pedal with the governor.

PRIMING FUEL SYSTEM

DESCRIPTION

The problem in restarting the engine after it runs out of fuel is that after the fuel is exhausted from the fuel tank, fuel is then pumped from the primary fuel strainer and sometimes partially removed from the secondary fuel filter before the fuel supply becomes insufficient to sustain engine firing. The primary fuel strainer and the secondary fuel filter must be refilled with fuel and the fuel lines must be free of air in order for the system to provide adequate fuel for the injectors.

When the engine runs out of fuel the following procedure should be followed for restarting the engine.

(1) Fill the fuel tank with recommended fuel oil, described earlier in the section. If only partial filling of the tank is possible, add a minimum of ten gallons of fuel.

(2) Remove the primary fuel strainer shell and element and fill the shell with fuel. Install the shell and element.

(3). Remove the secondary fuel filter shell and element and fill the shell with fuel. Install the shell and element.

(4). Start the engine. Check the filters for leaks.

NOTE: It may be necessary to remove a valve rocker cover and loosen a fuel pipe nut in order to bleed trapped air from the fuel system. Be sure the fuel pipe is retightened before replacing rocker cover.

FUEL FLOW CHECK

DESCRIPTION

A fuel flow check may be performed by disconnecting flexible fuel return line from fitting at rear bulkhead. Place return line end in a convenient receptacle. As fuel must pass through return line restriction fitting, do not disconnect line at bracket on top of engine. Start engine and measure fuel flow for a period of one minute while maintaining an engine speed of 1200 RPM. A fuel flow of approximately 0.8 gallon per minute is satisfactory.

Dip end of return line into container of fuel. Air bubbles rising to surface indicates that air is being drawn into fuel system on suction side of fuel pump. If air is present, tighten all fuel lines connections between fuel tank and fuel pump.

If fuel flow is insufficient for satisfactory engine performance, then check for faulty fuel lines, clogged fuel filters or fuel pump.

FUEL TANK

DESCRIPTION

A welded aluminum fuel tank with a capacity of 144 U.S. (120 Imperial) gallons is mounted behind the front axle. The fuel filler neck and cap are of the non-removable type. Fueling is performed through a door provided in the body paneling behind the right front wheelhousing. Provision is made in the body paneling for access to the fuel tank assembly if removal should be necessary. A whistle-type device is provided to indicate when the tank is 95% full, complying with vehicle regulations.

Prior to removal the fuel tank should be completely drained. Remove the access panel. Remove bar which secures the fuel tank in place. Disconnect the feed and return fuel lines. If the vehicle is equipped with a fuel gauge, disconnect the wire leading to the sending unit. Ensure that the filler neck is clear then carefully slide the fuel tank out of the compartment.

NOTE: On coaches without auxiliary fuel tank it will be necessary to raise the tank approx. 1/2" to allow the closing plate to clear the cutout in the floor.

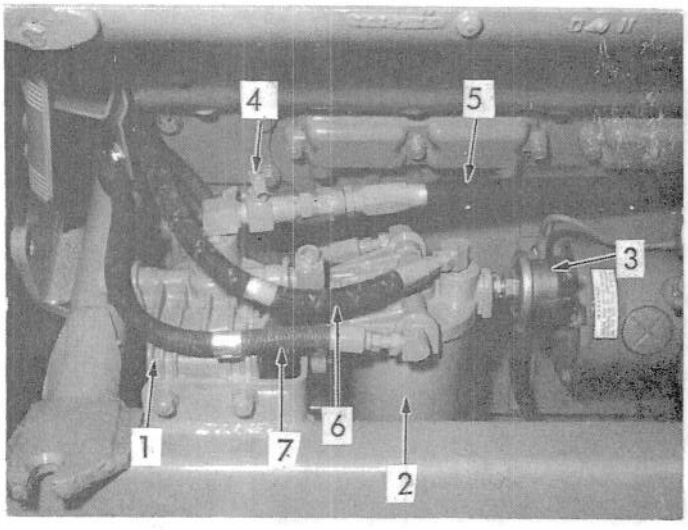
FUEL STRAINER & FUEL FILTER

DESCRIPTION

The fuel system is equipped with a fuel filter and a fuel strainer for additional protection to injectors. Shown in the following illustration is the filter, and strainer with mountings and fuel line connections. Refer to the engine manufacturer's instructions for disassembly, cleaning, and other service procedures.

Every 10,000 miles, open the drain at the bottom of the fuel tank to drain off any water or sediment.

The service interval at which the strainer and fitter elements should be changed is determined by operating conditions and the cleanliness of the fuel used.



1. Fuel Strainer
2. Fuel Filter
3. Fuel Pressure Switch
4. Shut-off Cock
5. Hose - From Fuel Tank
6. Hose - From Fuel Pump
7. Hose - To Injectors

FIGURE 9 - 2: Fuel Filter & Strainer Installed

A small amount of fuel should be drained daily from both strainer and filter to remove any dirt and water accumulations that may be present. Drain cocks are provided for this purpose.

To change strainer or fuel filter elements close shut-off cocks, Key #4 (Figure 9-2) open drain cock at bottom of filter shell and loosen cover nut sufficiently to allow fuel to drain out freely. Unscrew cover nut, withdraw and install new element. Replace shell and element using a new cover gasket. Make sure that the shell seats properly on the cover gasket before tightening the cover nut. Remove filler plug from cover and fill strainer or filter body with clean fuel oil, preferably using a fuel system primer. Open shut-off cock, Key #4 (Figure 9-2), after priming system.

AIR CLEANERS (OIL TYPE)

DESCRIPTION

Some coaches are equipped with four heavy duty oil bath air cleaners, located in the engine compartment at the left rear engine compartment door.

Engine air passes through a bank of four oil bath air cleaners before it enters the engine blower housing. Air is drawn into the air cleaner through a louvred opening at the left rear of the vehicle.

MAINTENANCE

Efficient engine operation depends on proper maintenance and service. Radiator shutters and blower dampers must work in conjunction with each other. If these assemblies have the air supply closed off, a decided increase in fuel consumption can occur. Periodic checks should be made to determine that no leaks are present in the connections and duct work in the system. Otherwise dust-laden air may bypass the air cleaners and enter the engine.

The service interval at which the air cleaner units should be serviced will depend upon the amount of dust present in the air. This will naturally vary with service conditions, season, etc. Air cleaner service should be sufficiently frequent to ensure that no appreciable amount of sludge builds up in the air cleaner cups.

To service air cleaners, loosen the clamp ring on each air cleaner unit, and remove oil cup. Empty the old oil and clean with fuel to remove all sludge. Inspect the cup for the presence of lint or dirt; wash using solvent or cleaning solution and blow out with compressed air or steam. Also check air cleaner center tube for dirt accumulations. If present, remove by passing a lint-free cloth through the center tube. Refill the air cleaner cup with oil of the same viscosity as used in the engine crankcase to the level indicated in the cup. Replace cups, making sure that a completely air-tight seal is made.

AIR CLEANERS (DRY TYPE)

DESCRIPTION

Some coaches are equipped with four dry-type replaceable element air cleaners, located in the engine compartment at the left rear of the coach.

Engine air enters the air cleaner through intake ducts and all foreign matter, dust, and dirt is pre-

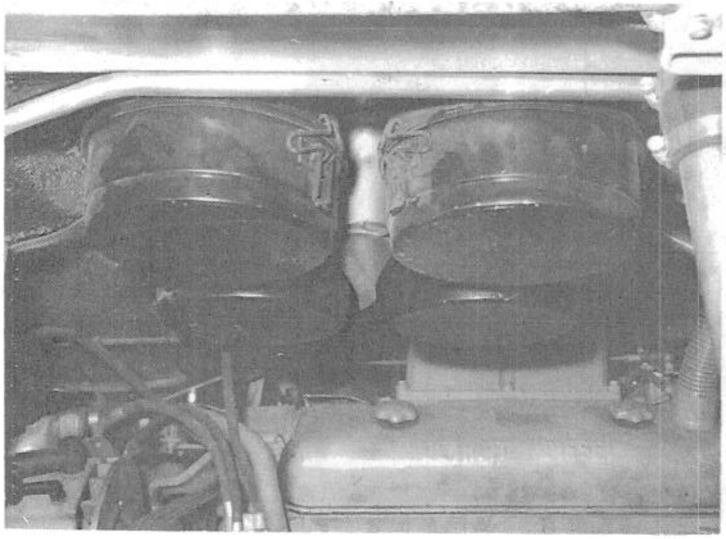


FIGURE 9 - 3: Oil Bath Air Cleaners Installed

vented from entering the engine by the filter element. The larger particles will drop to the bottom of the air cleaner (dust cup) and will collect in the vacuator valve until their weight forces the valve open allowing the foreign matter to drop out of the filter. This is a continuous, automatic process.

VACUATOR VALVE: The use of a vacuator valve on the air cleaner eliminates the need for removal of the dust cup to empty foreign matter. The valve should be inspected at regular intervals to determine if valve is plugging due to the presence of lint, chaff, etc., which may collect in the valve and require cleaning. To remove valve from dust cup, simply pull off, clean, and replace (Refer Figure 9-7).

CAUTION: Do not use any oil to clean valve or as an aid to install.

SERVICE PROCEDURE

Filter Element Replacement: When the air cleaner restriction indicator shows the red warning line, the filter element should be cleaned or replaced. To replace element proceed as follows:

1. Remove clamp band which fastens dust cup to body.
2. Remove wing bolt from inside element.
3. Remove element from filter body by pulling straight down.
4. Install new or cleaned element in reverse order of steps above.
   Note: Be sure gasket at wing nut is in good condition.
5. To release filter indicator, push upward on rubber dust cup.

Filter Element Cleaning: Follow instructions given on decal which is part of the element assembly. Note that there are two recommended methods of cleaning. When cleaning, **do not attempt to remove plastic fins.** Also, note that the element is to be air dried (if washed) and that air must be circulating.

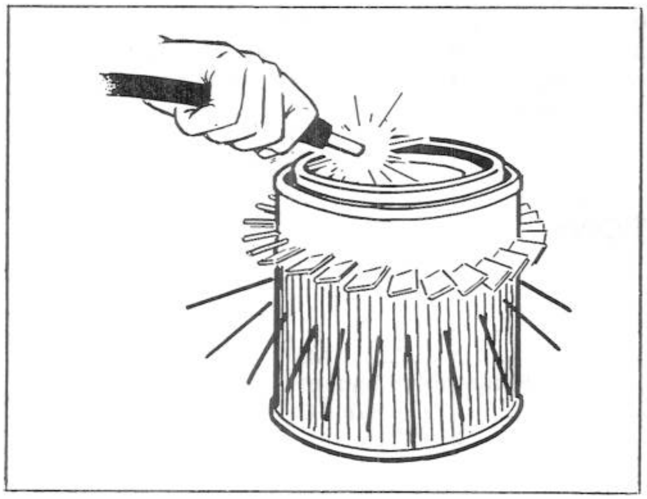


FIGURE 9 - 4: Cleaning with Air

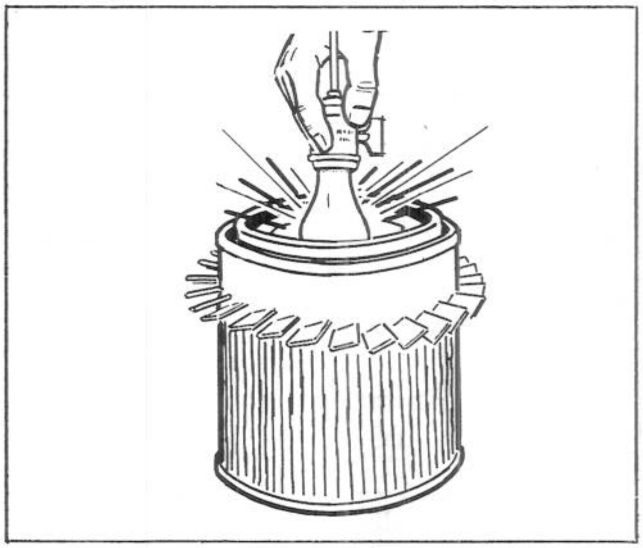


FIGURE 9 - 5: Inspecting for Damage

Do not dry by inserting light bulb inside element—light bulb is to be used for inspection only.

The filter element should be discarded after **six cleanings,** or **annually,** whichever occurs first. In some cases, if condition of filter element is bad, it should be discarded sooner. **Do not use element for longer than recommended as serious engine damage could result.**

To clean used element, use dry, clean compressed air. Direct air up and down pleats on the clean air side of the element. Maintain a distance of 1 inch from filter element and do not exceed 100 P.S.I. air pressure when cleaning filter (Refer Figure 9-4).

To wash element use D-1400 filter cleaner or equivalent.

NOTE: Instructions for cleaning with D-1400 cleaner are on container.

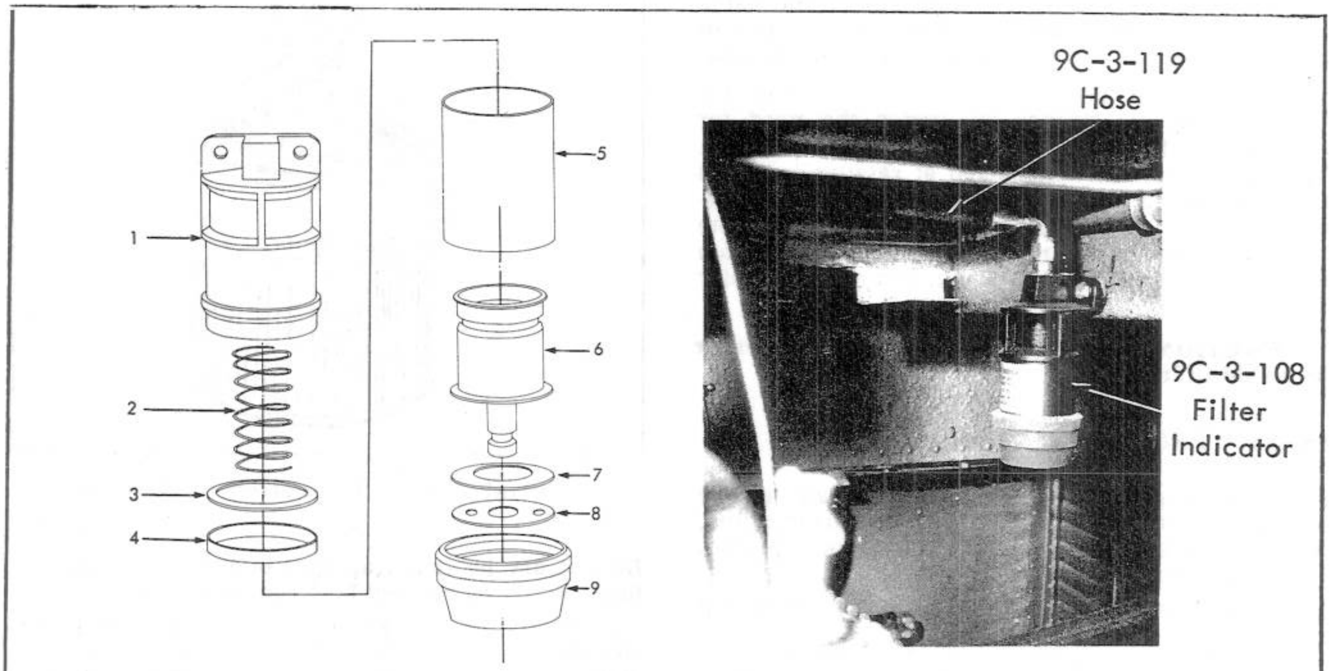
Filter must soak for 15 minutes or more, then rinse thoroughly with clean water. This can be done by water hose using maximum pressure of 40 p.s.i. Air-dry completely, wipe out interior with damp cloth and inspect as follows:

CAUTION: Do not install filter element unless completely dry as this will shorten cleanliness of filter life.

FILTER ELEMENT INSPECTION: After cleaning element, inspect it for damage. To detect paper ruptures, place a light inside element and inspect outside of element for holes and tears. (Refer Figure 9-5). Check the inside of paper pleats for presence of dust and dirt.

Check gaskets for damage.

Any defect in the filter element is reason for discarding it.



1. Body
2. Spring
3. Upper Gasket
4. Rubber Band
5. Glass Tube
6. Target & Reset Button Assy.
7. Thrust Washer
8. Bottom Cap
9. Rubber Boot

Figure 9-7: VACUATOR VALVE

11. Filter element gasket (damage).
12. Filter element (dirty, damage).

General Caution Notes:

1. Never operate the vehicle engine without an element in the air filter.
2. Do not remove plastic fins from filter elements.
3. Use only original equipment filter elements.
4. Whenever element has been removed from filter body, clean inside of filter body with a soft clean cloth.
5. **Do not ignore** the warning given by the air restriction indicator. To do so is to invite serious engine damage.
6. Store cleaned or new elements in a protected area free from dust and damage.
7. Use the proper element when replacing element in filter.

Torquing Specifications

Dry Air Cleaners— When reassembling the inner flange assembly to Air Cleaner Manifold with 3/8" countersunk screws, torque down to 17 ft. lbs. (Refer Figure 9-6).

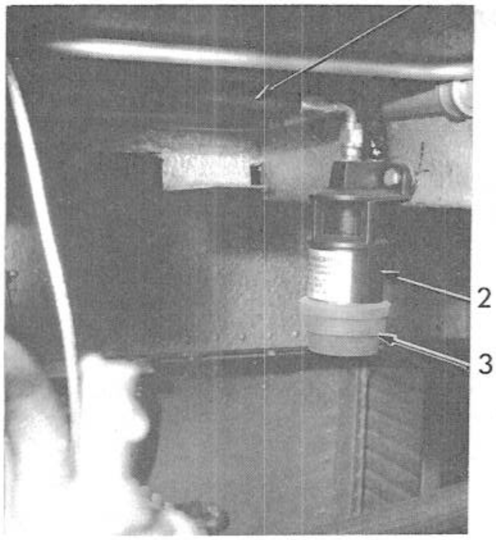
SPECIFICATIONS

FUEL FILTER - PRIMARY

Make	AC
Type	Renewable Element
Element Part No.	5575032
Retaining Bolt Torque	25-30 ft. lbs.

FUEL FILTER - SECONDARY

Make	AC



1. Hose - Filter Indicator to Air Intake Manifold
2. Filter Indicator
3. Dust Cap

FIGURE 9 - 8: Filter Indicator Installed

Filter Inspection Check-Off: Check the following items at regular intervals:

1. Vacuator Valve
2. Mounting bolts and brackets.
3. Air cleaner body damage.
4. Restriction indicator connection (leak).
5. Body to inlet joint (damage).
6. Body to outlet joint (leak).
7. Plastic fins on element (plugging and damage).
8. Dust cup gasket (leaks).
10. Connections to engine (leak, damage).
11. Filter element gasket (damage).
12. Filter element (dirty, damage).

General Caution Notes:

1. Never operate the vehicle engine without an element in the air filter.
2. Do not remove plastic fins from filter elements.
3. Use only original equipment filter elements.
4. Whenever element has been removed from filter body, clean inside of filter body with a soft clean cloth.
5. **Do not ignore** the warning given by the air restriction indicator. To do so is to invite serious engine damage.
6. Store cleaned or new elements in a protected area free from dust and damage.
7. Use the proper element when replacing element in filter.

Torquing Specifications

DRY AIR CLEANERS: When reassembling the inner flange assembly (9C-3-111) to air cleaner manifold with 3/8" countersunk screws, torque down to 17 ft. lbs. (Refer Figure 9-6).

SPECIFICATIONS

FUEL FILTER - PRIMARY

Make	AC
Type	Renewable Element
Element Part No.	5575032
Retaining Bolt Torque	25-30 ft. lbs.

FUEL FILTER - SECONDARY

Make	AC
Type	Renewable Element
Element Part No.	5574508
Retaining Bolt Torque	25-30 ft. lbs.

SPECIFICATIONS (Cont'd)

FUEL TANK

Capacity, Imperial Gallons	120
Capacity, U.S. Gallons	144
Auxiliary Fuel Tank	35 U.S. Gals.

AIR CLEANERS (OIL TYPE)

Number Used	4
Make	AC
Element No.	9B-3-40-5649952

AIR CLEANERS (AIR TYPE)

Number Used	4
Make	Donaldson
Element No	9C-3-110-P104972

AIR RESTRICTION INDICATOR

Number Used	1
Make	Bacharach
Indicates	@ 25" Water

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

LUBRICATION

LUBRICATION

A lubrication chart is included in this section to give approximate location of key service points on the coach. Where cleaning, removal or disassembly are required for lubrication purposes, these procedures are covered in the applicable sections of this manual.

Lubrication intervals are based on recommendations for normal operating conditions. Where more severe service is encountered, more frequent attention will be required.

NEW COACHES

Lubricant in the transmission and differential supplied as "factory fill" in new coaches should be drained and refilled after 1,000 miles (and in no case over 3,000 miles) of initial operation.

ENGINE CRANKCASE

Engine crankcase oil should be checked daily or before the start of each run and oil added to bring the level to the "Full" mark on the dipstick. A new oil filter element should be installed each time the crankcase oil is changed.

The maximum recommended time between oil changes is 3,000 miles for highway vehicles and 1,000 to 2,000 miles for vehicles operating under dusty or more severe conditions.

Engine oil temperature should be checked every 25,000 miles to determine oil cooler efficiency. This check should be made by inserting a steel jacketed thermometer in the dipstick opening immediately after stopping a hot, loaded engine. If the oil temperature exceeds the coolant temperature by more than 60 degrees, the oil cooler may be clogged.

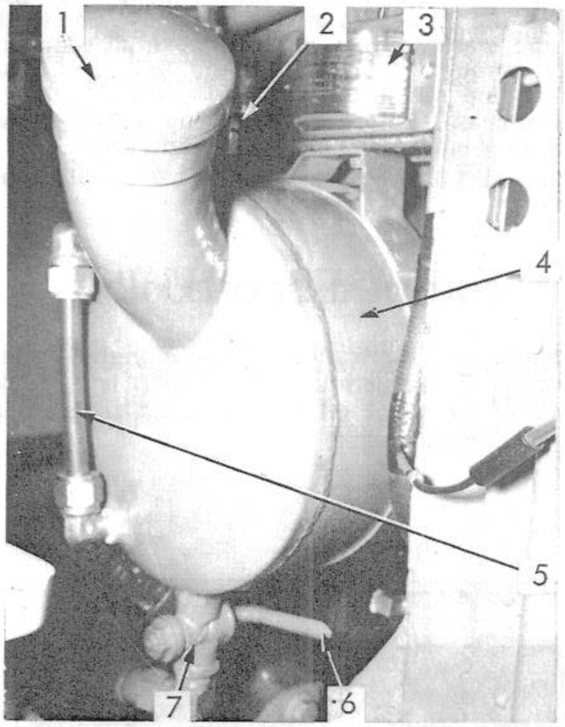
CHECKING OIL LEVELS

Lubricant compartments of the engine and transmission are provided with dipsticks for checking lubricant level. Power steering fluid reservoir and blower drive gear box are equipped with sight gauges to facilitate checking of oil level.

OIL RESERVE TANK

DESCRIPTION

Available as optional equipment is a two-gallon oil reserve tank. It is connected to the crankcase by a hose with a shut-off valve, allowing oil to be added to crankcase by opening valve. Comparison of oil levels in sight gauge, before and after adding oil to crankcase, shows how much oil has been added.



1. Filler Neck Cap
2. Breather
3. R.H. Engine Compt. Light
4. Oil Reserve Tank
5. Sight Gauge
6. Valve Handle
7. Air Drain Valve

Figure 10-1: Oil Reserve Tank

LUBRICATING OIL

Satisfactory prolonged heavy-duty engine operation requires heavy-duty lubricating oils with additives. These oils provide better lubrication, have more heat resistance and counteract sludge formation more effectively than the straight mineral type oils. Refer to Section 8 "Engine" for detailed oil specifications.

AIR CLEANERS (OIL TYPE)

DESCRIPTION

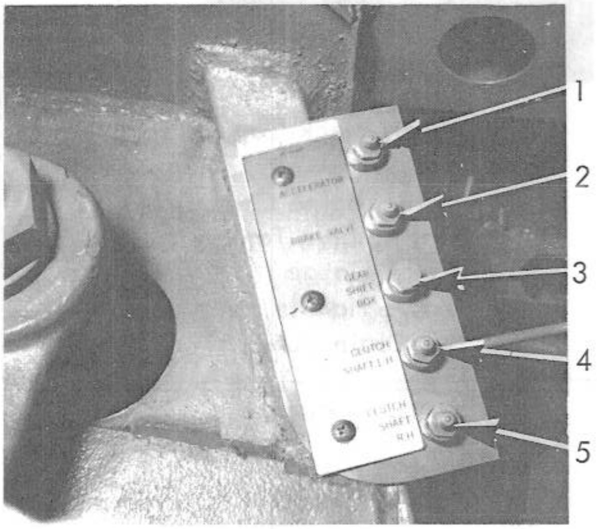
Four oil-bath air cleaners are used in place of the dry type on some coaches. They should be serviced every 3,000 miles, or more often if particularly dusty operating conditions are encountered.

To service air cleaners, loosen clamp ring which secures the oil cup to air cleaner body. Empty the cup and wash in fuel oil to remove all sediment. Drain thoroughly and refill to the "Oil Level" mark with engine oil of the same viscosity as used in the crankcase. Before replacing cup, check gaskets and sealing surfaces to ensure air-tight seals.

Standard dry-type air cleaners use a replaceable element.

COLD WEATHER OPERATION

The proper lubrication oil viscosity grade when operating at temperature above 30°F is SAE 30. A lighter grade of oil may be used to facilitate cold weather starting.



1. Accelerator Cross Shaft
2. Brake Valve
3. Gear Shift Box
4. Clutch Cross Shaft L.H.
5. Clutch Cross Shaft R.H.

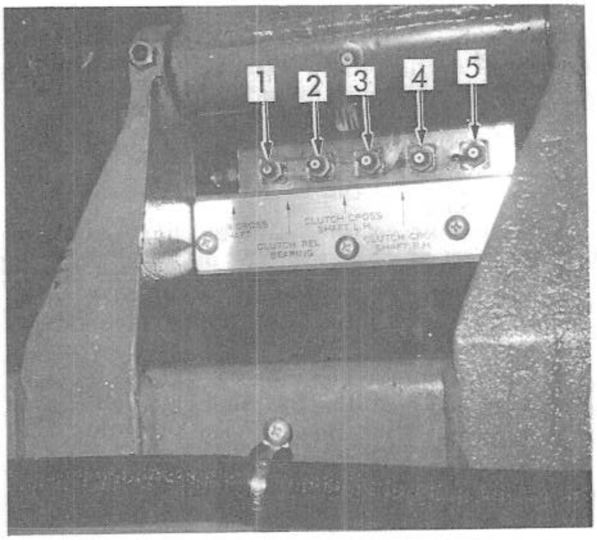
Figure 10-2: Front Master Lub. Plate

FRONT END LUBRICATION

DESCRIPTION

A plate mounting five grease fittings is mounted to a master bracket in the L.H. front tool compartment to the rear of the pitman arm. These zerk fitting are connected to lubricating lines which lead to points listed on nameplated. Refer to Figure 10-2:

The nameplate explains the function of each fitting. Drip pans are provided at the designated points to prevent grease from dripping in places where it would be objectionable. Due to surplus lubricant being applied to the gearshift box, a pipe plug has been installed at No. 3, refer to Figure 10-2. Do not overfill when lubricating at this point. Regular lubrication at point No. 3 is not required.



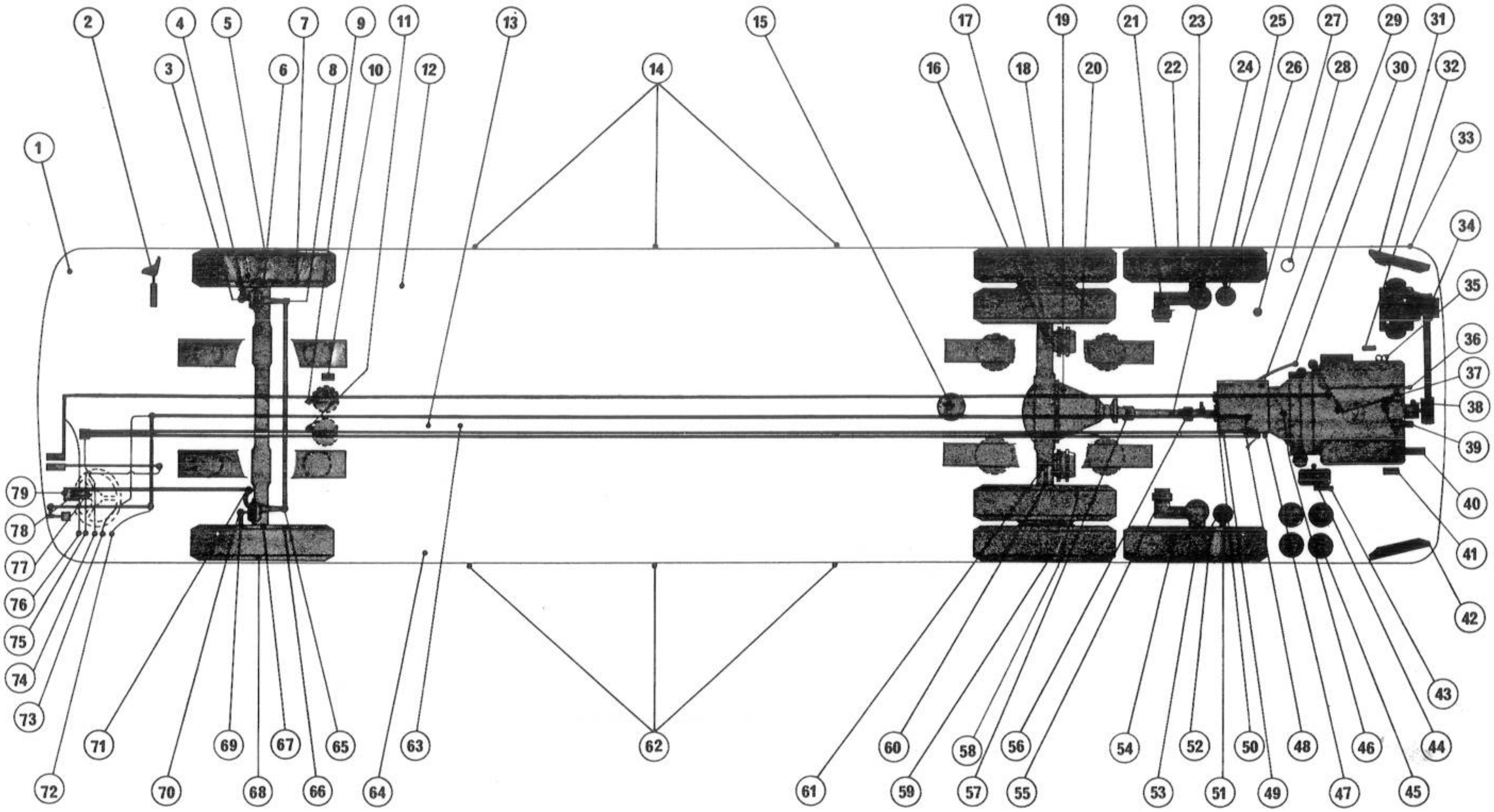
1. Lever Cross Shaft
2. Clutch Release Bearing
3. Clutch Cross Shaft L.H.
4. Clutch Cross Shaft R.H.
5. Accelerator

Figure 10 - 3: Rear End Lub. Plate

REAR END LUBRICATION

DESCRIPTION

A plate mounting five grease fittings is mounted on the alternator pivot mounting bracket and can be reached by opening the left hand rear side service door. These zerk fittings are connected to lubricating lines when lead to points listed in Figure 10-3.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REFER TO LUBRICATION SCHEDULE
FOR LUBRICANT RECOMMENDATIONS
AND SERVICE MANUAL

LUBRICATION CHART
MODEL MC-7
OCT. 9/68

LUBRICATION CODE

O-1	Engine Oil SAE 30. Refer to Section 8 "Engine" for Oil Spec.
O-2	Rust Preventative Oil
O-3	Engine Oil SAE 10MS or DS Service
O-4	Delco Lubricant 1948791 or Chevron BRB-2
L-1	Multi-Purpose Lithium - Base Grease
L-2	High Melting Point Water - Resistant Lithium - Base Grease
L-3	"Lubriplate" #105
L-5	Molybdenum Disulphide Grease
* G-1	General Purpose Gear Lubricant - SAE 90
* G-2	General Purpose Gear Lubricant - SAE 140
F-1	Silicone Fluid - 750 Centistokes Viscosity
F-2	Special "Kysor" Air Filter Fluid

* For Rear Axle Use A.P.I. Spec. GL5

LUBRICATION SCHEDULE

SERVICE AS REQUIRED

Item No.	Description	Lube Method	Lube Type
12	Battery Terminals 6 oz. Spray Can - Part No.99GA 12 oz. Spray Can - Part No. 99MA Manufacturer is: Permatex Company, Inc., Flagercourt Bldg., West Palm Beach, Florida, 33401.	Spray On	
37	Power Steering Reservoir	Fill	O-3

SERVICE EVERY 1,500 MILES

Item No.	Description	Lube Method	Lube Type
3,70,16,26,52 & 61	Brake Slack Adjusters	Zerk	L-1
4,69,17,25,51 & 60	Brake Cam Shafts	Zerk	L-1
6 & 67	Steering Knuckles	2 Zerk	L-1
8 & 65	Steering Tie Rod Ends	Zerk	L-1
75	Brake Valve Linkage	Zerk	L-1
24	Propeller Shaft Slip Joint	Zerk	L-1

LUBRICATION SCHEDULE (Cont'd)

43	Clutch Release Bearing	Zerk	L-1
43	Clutch Throwout Shaft	Zerk	L-1
56 & 57	Propeller Shaft U-Joints	Zerk	L-1
71 & 79	Steering Booster End & Drag Link End	2 Zerk	L-1
76	Accelerator Cross Shaft	Zerk	L-1
72	Clutch Cross Shaft Front L.H. Brg.	Zerk	L-1
73	Clutch Cross Shaft Front R.H. Brg.	Zerk	L-1
48	Transmission Shaft Rods	2 Zerk	L-1
48	Clutch Control Rod	Zerk	L-1
46	Throttle Control Linkage	Zerk	L-1
78	Steering Gear	Fill	G-1
7,20,22,54,58 & 66	Brake Anchor Pin	Zerk	L-1
43	Clutch Lever Cross Shaft	Zerk	L-1
21 & 55	Trailing Axle Pivot	Zerk	L-5

SERVICE EVERY 3,000 MILES

Item No.	Description	Lube Method	Lube Type
40	Engine Crankcase	Change	O-1
41	Engine Oil Filter	Element	Exchange
45	Air Cleaners	Clean or Change (Dry Type) (Oil Bath)	O-2

SERVICE EVERY 10,000 MILES

Item No.	Description	Lube Method	Lube Type
1	Entrance Door Upper Hinge	Zerk	L-1
1	Entrance Door Lower Hinge	Apply	L-3
31 & 42	Radiator Shutters and Linkage	Apply	O-2
32	Shutterstat Air Filter	Add	F-2
39	Blower Drive Gear Box	Plug	O-1
	Service Door Hinges	Apply	L-3
35	Fuel Filter and Fuel Strainer	Element	Exchange

SERVICE EVERY 15,000 MILES

Item No.	Description	Lube Method	Lube Type
30	Transmission (Drain, Flush and Refill)	Change	O-1

19	Differential (Drain, Flush and Refill)	Change	G-1 (-0° F.) G-2 (+0° F.)
18 & 59	Wheel Bearings (Rear Drive Wheels) (Drain, Flush and Refill)	Change	G-1 (-0° F.) G-2 (+0° F.)
49	Transmission Oil Filter	Element	Exchange
5,68,23 & 53	Wheel Bearings (Front and Trailing) (Drain, Flush and Refill)	Change	O-1

SERVICE EVERY 25,000 MILES

Item No.	Description	Lube Method	Lube Type
50	Speedometer Cable	Apply	L-2
50	Tachograph Cable	Apply	L-2
50	Angle Drive	Zerk	L-1

SERVICE EVERY 50,000 MILES

Item No.	Description	Lube Method	Lube Type
14 & 62	Baggage Door Locks	Apply	L-3
77	Steering Column U-Joints	Zerk; Pack Lower Joint	L-1
48	Clutch Air Assist Cylinder	Apply	O-1
77	Steering Column Upper Bearing	Apply	O-1

SERVICE EVERY 75,000 MILES

Item No.	Description	Lube Method	Lube Type
37	Power Steering Reservoir	Element (Paper)	Exchange
27	Power Steering Oil Filter	Element (Brass)	Clean
74	Shift Lever Box	Zerk	L-1

SERVICE AT OVERHAUL

Item No.	Description	Lube Method	Lube Type
4,17,25,51,60 & 69	Brake Cam and Shoe Rollers	Pack	L-3
44	Alternator	Pack	O-4
63 & 64	Condenser and Evaporator Motor	Pack	L-1
	Starting Motor	Pack	L-1
	Height Control Valves	Add	F-1

STEERING

STEERING

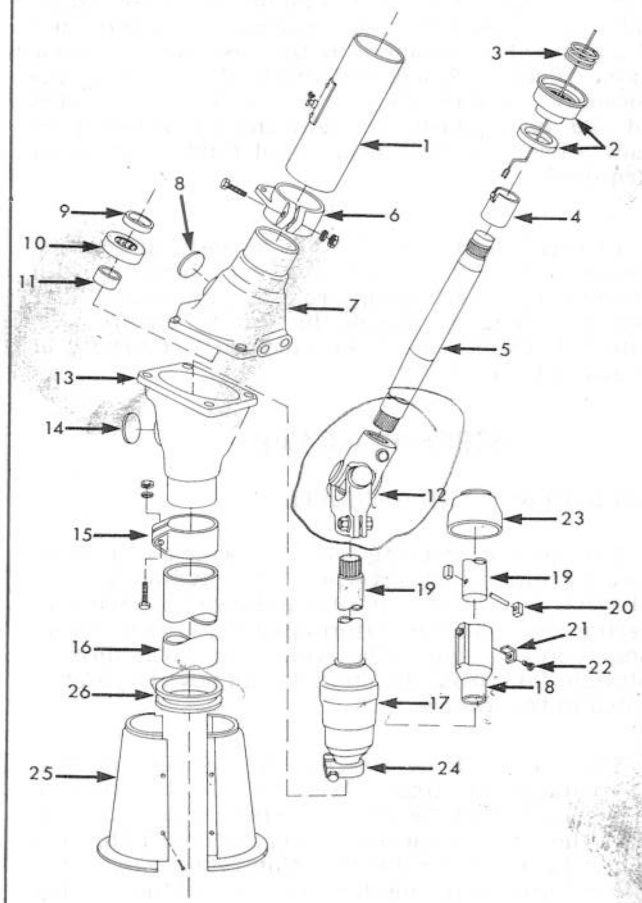
Standard equipment is hydraulic power steering using a Ross series 71 steering gear. A 1¾" diameter ball end is riveted to the steering drop arm. The steering wheel is 2-spoke, 21" in diameter, of Tenite material. The horn buttons are in the spoke of the wheel. Universal joints are provided in the steering column to afford the correct steering wheel angle. A heavy-duty self-cancelling directional signal switch is mounted to the steering column, readily removable for servicing. A double acting hydraulic cylinder applies power assistance to the steering gear drop arm. Hydraulic fluid is supplied by a vane type pump located on and gear-driven from the engine. A reservoir and filter are also provided in the power steering hydraulic system.

A sight gauge is installed in the fluid reservoir for quick, convenient checking of the fluid level.

MAINTENANCE

It is recommended that a periodic check be made of tightness of fasteners in the steering system. Refer to end of section for "Torque Specification". After torque checks have been made, check steering wheel lash at the steering wheel rim as follows:

1. With the engine running, turn steering wheel to bring the front roadwheels of the coach into a straight ahead position.

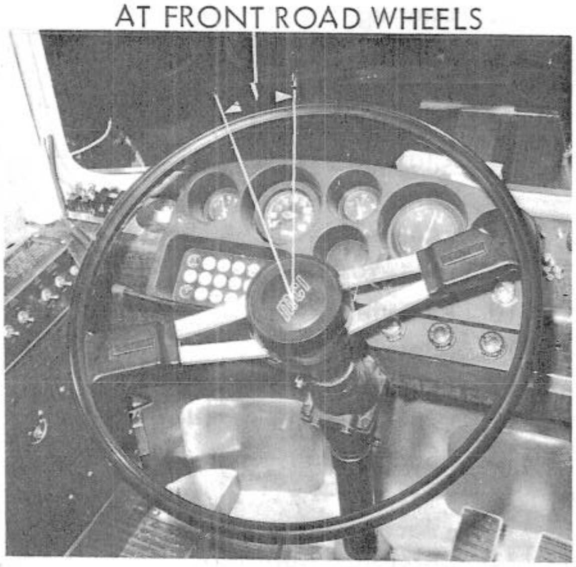


1. Jacket Tube Assy.
2. Bearing
3. Spring
4. Contact Ring
5. Wheel Shaft Assy.
6. Clamp - Upper
7. Joint Housing & Plug Assy.
8. Snap Plug
9. Felt Washer
10. Bearing
11. Bearing Spacer
12. Universal Joint
13. Joint Housing & Plug Assy.
14. Snap Plug
15. Clamp Assy.
16. Jacket Tube
17. Flexible Coupling
18. Shell Assy.
19. Wheel Shaft Assy.
20. Button
21. Lockwasher
22. Cap Screw
23. Seal
24. Clamp
25. Base Cover
26. Grommet

Figure 11 - 1: Steering Column Assembly

2. Set up a pointer at the steering wheel rim, it may be clamped to any rigid part of coach in vicinity of steering wheel as convenient.
3. Have one man watch the front road wheels. Turn the steering wheel very slowly LEFT, stop turning the steering wheel at the instant the road wheels start to move.
4. Mark steering wheel rim in line with pointer.
5. Turn the steering wheel very slowly RIGHT. Stop at the instant the road wheels start to move.
6. Mark the steering wheel again in line with pointer. Measure the distance between the two marks, either in inches at the rim or as an angle with its apex at the steering wheel center. This measurement must not be over 2" or 10°.

2" OR 10° MAXIMUM
WITH NO MOVEMENT
AT FRONT ROAD WHEELS



NOTE: THE ABOVE READING MUST BE TAKEN WITH ENGINE RUNNING.

FILLING POWER STEERING SYSTEM: When the power steering hydraulic fluid system is drained, or if any lines or connections are removed, it is necessary to bleed air completely from the system to ensure satisfactory operation.

HYDRAULIC SYSTEM: Use SAE No. 10W motor (Service MS).

Fill the reservoir to the recommended level as indicated on the reservoir. If the level is higher, overflow will occur during operation. If the level gets too low, air will be drawn into the system.

The proper refilling and bleeding procedure is as follows:

Raise front end of vehicle until wheels clear the floor. Fill the power steering fluid reservoir, located in the engine compartment, to the FULL mark. Allow the fluid to remain undisturbed for about two minutes. Turn wheels to left and right in order to remove air from the power steering cylinder, adding fluid to the reservoir as needed to maintain level to the FULL mark. Continue until air bubbles no longer show in the reservoir.

Start engine and operate on idle speed. Turn wheels to right and left, but do not hit wheel stops. Add fluid as needed at the reservoir. Continue until all air bubbles disappear at the reservoir. Increase engine speed to 2/3 of full throttle, continuing the procedure outlined above. Lower the vehicle front end and turn wheels to right and left a few more times. Check for fluid leaks. Add fluid to reservoir if required.

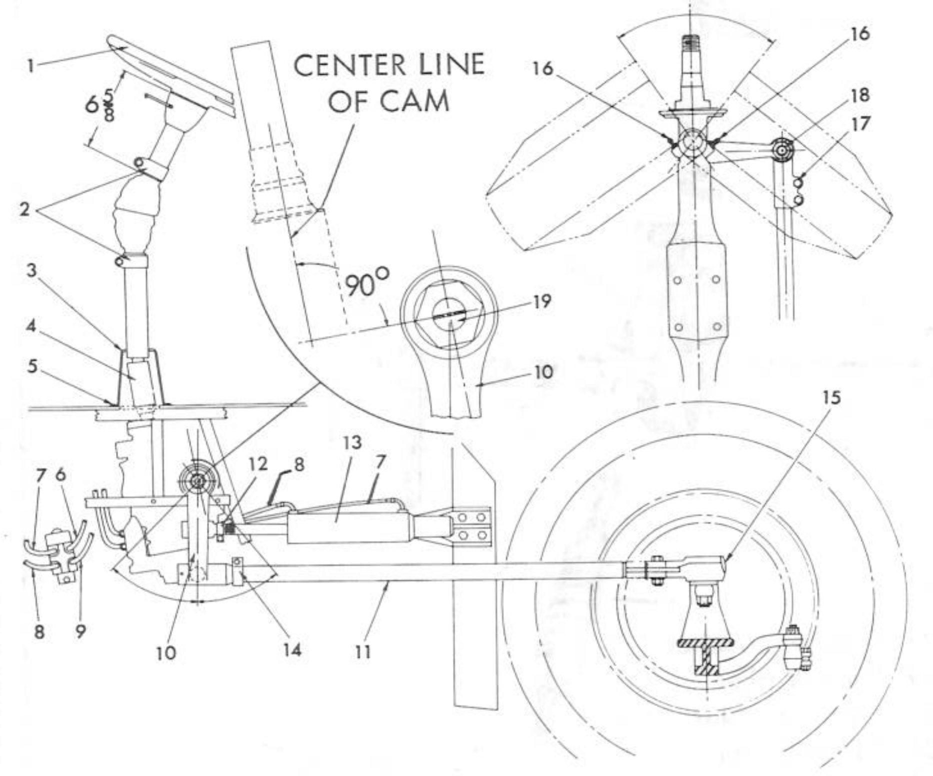
LUBRICATION: Use SAE 90 gear and transmission oils. Fill the steering gear housing with lubricant. Fill the housing from the uppermost filler plug. The housing should be full to ensure adequate lubrication of all internal parts. Capacity of the gear housing is 7 pints.

STEERING GEAR

DESCRIPTION AND OPERATION

The power steering gear is a semi-integral hydraulic unit which incorporates a hydraulic control valve on a twin stud cam and lever mechanical steering gear. Steering effort applied to the steering wheel actuates the valve which, in turn, directs hydraulic fluid from the pump to the power cylinder located in the linkage.

The action of the steering gear is both manual and hydraulic in effect. When the cam is turned to the left or right by the driver's effort on the steering wheel, the studs of the inner lever are moved through the groove of the cam (worm), thus rotating the lever shaft and providing angular movement of the steering gear pitman arm. Whenever the driver's effort at the steering wheel exceeds the preload of the centering springs, the control valve is actuated and the hy-



1. Steering Wheel
2. Clamp
3. Floor Cover
4. Universal Joints
5. Oval Hd. Screws (Type "A")
6. Port (To Reservoir)
7. Port (to Cylinder)
8. Port (to Cylinder)
9. Port (from Pump)
10. Pitman Arm
11. Drag Link
12. Clamp
13. Booster Cylinder
14. Clamp
15. Stud Nut End
16. Stop Screw
17. Tie Rod End
18. Stud Nut
19. Lever Shaft

Figure II - 2: Steering and Installation

draulic power is applied to provide the driver with power assistance.

The valve spool is moved axially as the cam is moved axially although these parts are restrained from axial movement by the centering springs in the actuator. The effect of the springs is to center the actuator and valve spool (unless the steering force is great enough to overcome the spring load in which case the actuator and spool are moved axially.)

When the valve is in the center position, the oil pressure at the two cylinder ports is low and equal and produces ineffective forces in the cylinder. This results in no movement of the piston and no circulation of oil in the lines to the cylinder, however, oil is circulating from the pump through the control valve to the reservoir with sufficient pressure only to overcome friction of lines and fittings.

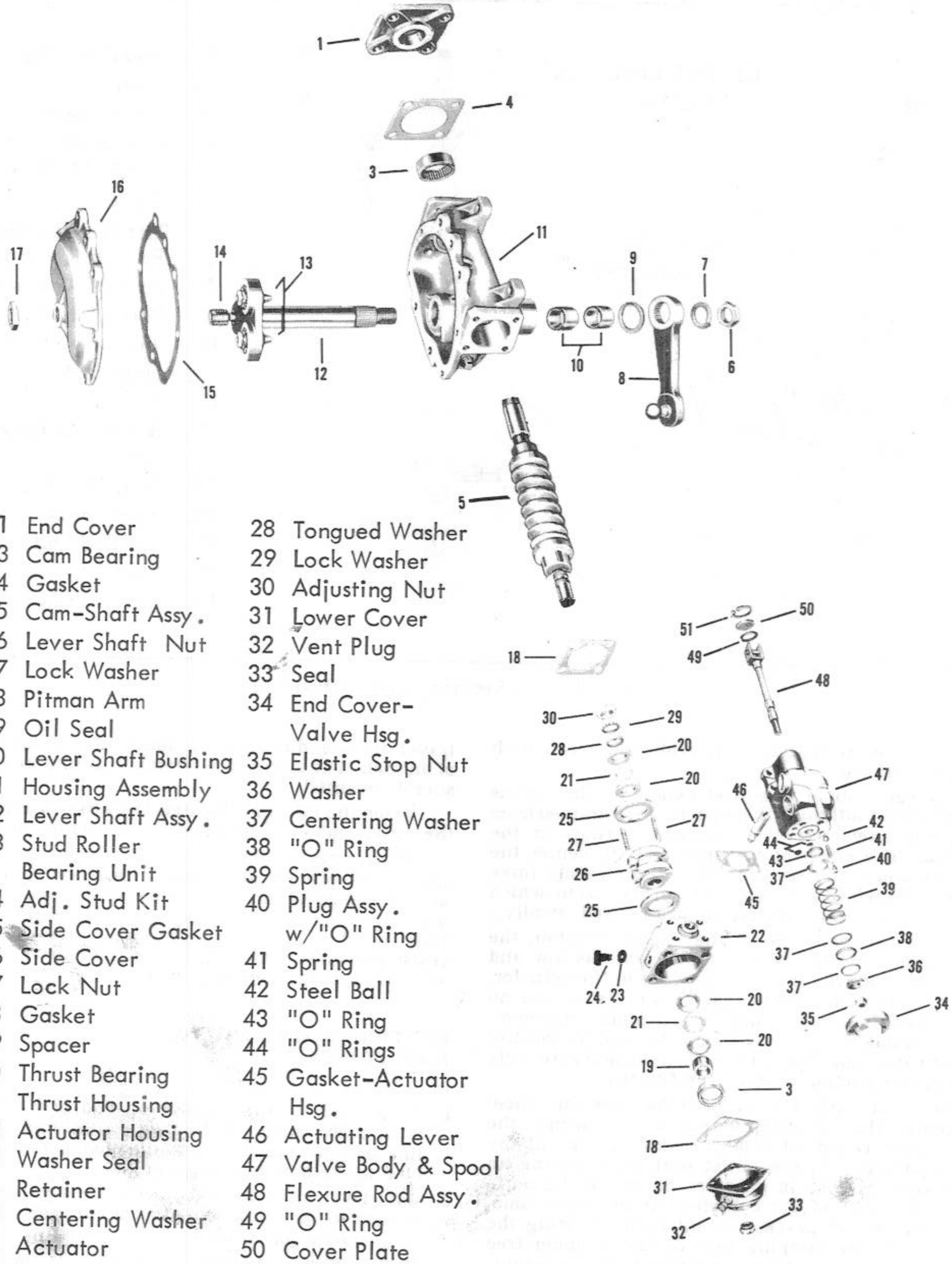
When the driver's effort at the steering wheel overcomes the centering effect of the springs, the valve spool is moved axially restricting one of the return passages to the outlet port thus causing an immediate increase in pressure at one of the ports and in one end of the cylinder. At the same time, the other return passage is enlarged, allowing the oil from the discharging end of the cylinder free passage to the outlet port and return to the reservoir. The immediate effect is increased pressure in one end of the cylinder to actuate the piston which applies hydraulic power directly to the steering gear pitman arm. Full pressure is obtained with a valve spool travel in one direction of about fifty thousandths of an inch. The slightest movement results in a pressure differential.

When the effort at the steering wheel is released, the valve spool is returned to the center position.

If the coach front wheels are subjected to shock loads, the pitman arm, acting through the inner arm of the gear, shifts the cam actuator and control valve spool axially in the appropriate direction directing the fluid to the proper side of the piston to resist the shock forces. This blocking action prevents kickbacks at the steering wheel.

CENTERING STEERING ON HIGH POINTS

1. Turn steering until groove on end of lever shaft is at a 90° angle to the cam center line. Center line of cam may be determined using a machined face on the box as a gauge point.
2. With lever shaft in this position, and pitman arm as near to vertical as possible, ball stud of steering arm should be directly over center line of axle. If not, adjust drag link length (14).
3. At this point check position of steering wheel as well. If not centered, remove and rotate the required number of serrations.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1	End Cover
3	Cam Bearing
4	Gasket
5	Cam-Shaft Assy.
6	Lever Shaft Nut
7	Lock Washer
8	Pitman Arm
9	Oil Seal
10	Lever Shaft Bushing
11	Housing Assembly
12	Lever Shaft Assy.
13	Stud Roller Bearing Unit
14	Adj. Stud Kit
15	Side Cover Gasket
16	Side Cover
17	Lock Nut
18	Gasket
19	Spacer
20	Thrust Bearing
21	Thrust Housing
22	Actuator Housing
23	Washer Seal
24	Retainer
25	Centering Washer
26	Actuator
27	Springs
28	Tongued Washer
29	Lock Washer
30	Adjusting Nut
31	Lower Cover
32	Vent Plug
33	Seal
34	End Cover-Valve Hsg.
35	Elastic Stop Nut
36	Washer
37	Centering Washer
38	"O" Ring
39	Spring
40	Plug Assy. w/"O" Ring
41	Spring
42	Steel Ball
43	"O" Ring
44	"O" Rings
45	Gasket-Actuator Hsg.
46	Actuating Lever
47	Valve Body & Spool
48	Flexure Rod Assy.
49	"O" Ring
50	Cover Plate
51	Retainer

Figure II - 3: Power Steering Gear

THRUST BEARING ADJUSTMENT

Remove the lower cover (31) so that the adjusting nut (30) on the cam shaft (5) is accessible. Before adjusting thrust bearings turn gear off its mid-position to free the studs (13) in the cam groove (5).

Reassemble screws in actuator housing (22) with 3/8" thick spacers under heads of screws. This is to hold the actuator and cam assembly in the gear when making the adjustment. Straighten prong of lockwasher (29). Remove adjusting nut (30), tongued washer (28), and upper thrust washers and thrust bearings (20, 21).

Ensure that the threads of the nut and camshaft are free of interference by running the nut onto the camshaft using only the fingers to turn the nut. If the nut cannot be turned all the way with finger torque, the threads are fouled and must be cleared with a thread file or other means until the nut goes on freely.

Reassemble thrust washers and thrust bearings (20, 21), tongued washers (28, with internal lug), and adjusting nut (30). Adjust as follows:

Turn on nut (30) and tighten to 10 foot pounds torque. Back off nut 10 degrees to 20 degrees by moving the nut relative to the pronged washer approximately 1½ times the width of a lug. Observe the lug nearest in alignment with a notch in the adjusting nut and bend the lug tight against the notch root. Reassemble lower cover (31).

CAM GROOVE ADJUSTMENT

NOTE: Backlash of the stud in the cam groove shows up as backlash at the steering wheel and at the ball on the steering arm.

The groove of the cam is cut shallow, and therefore, narrower in the mid-position range of stud travel to provide close adjustment where the straight ahead driving action usually takes place.

Adjust through mid-position to the high spot. Do not adjust in an end position. Backlash in the end positions is normal and not objectionable.

Turn gear 1 to 2 cam turns off mid-position. Push and pull lever shaft endwise alternately to check for excessive play in the adjusting stud assembly. If more than .003" end play exists, proceed with adjustment as follows:

Break stake of plug (C) to permit rotation in retainer (D). End play may be none (zero) to .003". Screw plug (C) clockwise to reduce end play of adjuster stud. Re-stake the flange of plug (C) to lock plug to slot in retainer (D) and proceed with adjustment as described below:

Loosen lock nut (G). Screw retainer (D) clockwise into side cover until a slight drag is felt when turning the taper studs through the high spot on the cam.

Back out (counter-clockwise) retainer (D) approximately 1/16 turn to barely eliminate the slight drag over the high spot. Turn cam from extreme left turn to extreme right turn and reverse to check for tight spots. If no tight spots exist, tighten lock nut (G) tight. After adjustment is locked with lock nut, turn gear through full travel (extreme left turn to extreme right turn, or vice versa) to check adjustment.

After this adjustment, reconnect the gear at all points loosened prior to making the adjustment. Also check tightness of mounting flange bolts and nuts, steering arm on lever shaft, and nut on the lever shaft.

STUD ROLLER BEARING UNITS: The foregoing adjustments will suffice in nearly every instance, but in some cases it may be necessary to adjust the stud roller bearing units in the lever shaft. In order

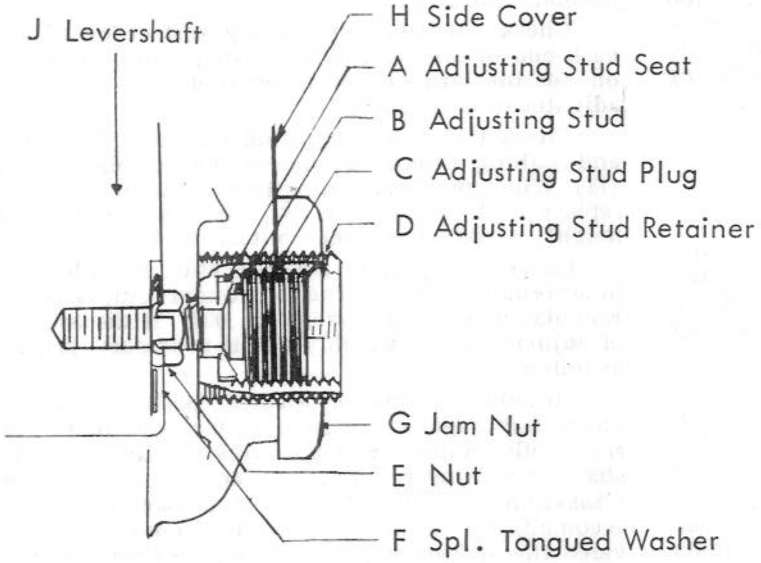


Fig. 11 - 8: Side Cover Push-Pull Adjuster.
Power Steering Gear

to make this adjustment the shaft must be removed from the gear. The roller bearings should be preloaded at all times. Adjust to a noticeable drag.

CAUTION: Use extra care in the following adjustment:

Factory adjustments on new units are set to 1 to 4 inch-pounds of torque to revolve stud. Used or replacement units should also be set to the same torque. Revolve stud several times before checking torque.

NOTE: Operation of a correctly adjusted bearing unit may feel rough to the hands but under steering load it will be smooth. The preload will assure normal service life. The stud should be rotated several full turns and reversed before checking rolling torque.

Wash bearings in solvent and lubricate with oil recommended for lubrication of gear. Should any roller be damaged or lost, replace with a complete new set. Do not make a partial replacement. Use a new lockwasher. Tighten nut as required. (Hold stud from turning by using spanner wrench on washer.) Revolve stud several complete turns and reverse to test adjustment.

Lock adjustment by bending over a lockwasher prong that is at a right angle to a side of the nut. Do not use the washer twice unless the prong used has been removed.

VALVE: (Centering) If steering leads to either right or left, valve adjustment may be performed in following manner:

1. Loosen four capscrews mounting valve to gear box.
2. Allow valve to move on gear until centered between springs, tighten capscrews carefully insuring that the valve does not move as bolts are tightened.
3. Jack front wheels off ground, start engine and run at fast idle. Wheels should not move to either left or right if valve is centered correctly.

CAUTION: Before adjusting valve check steering column to see if gear box slip joint is not applying force on the worm shaft. If steering column is too low, closing joint, coach will tend to lead right as force will be applied in same manner as right turn. If column is too high, joint will lift worm causing lead to left as applied in left turn.

REMOVAL OF GEAR FROM CHASSIS

Before removing the gear from coach, note the hookup of hydraulic lines. Identify by tagging the lines and noting the ports each is connected to.

CAUTION: Plug all ports and lines to keep out dirt.

Remove the steering gear arm (8) from lever shaft (12). Use an arm puller if possible. Do not hammer the arm off without using a support against the end of the shaft. Use light blows as they are more effective.

Remove clamp bolt on lower universal to free gear from steering column. Remove the flange bolts and remove the gear from the chassis. Clean the steering gear thoroughly but DO NOT STEAM CLEAN.

REMOVAL OF LEVER SHAFT: Remove the cap screws holding the side cover (16) to the housing (11). Remove the side cover and lever shaft as a unit. (Ensure that the lever shaft has no burrs on the outer end of the shaft that could cause damage to the housing, bushings or oil seal.)

REMOVAL OF CONTROL VALVE - TYPE V14: Remove four screws holding valve (47) to actuator housing (22) and remove valve. Pull out actuator lever (46).

REMOVAL OF CAM: Remove the screws holding lower cover (31) and actuator housing (22) to gear housing (11). Unlock actuator retainer screw (24) and remove the actuator housing.

Remove adjusting nut (30) after straightening bent prong of lockwasher (29). Remove tongued spacer washer (28) and lower thrust washers and thrust bearing (20, 21).

Remove lower centering washer (25) from the end of actuator (26) and remove the actuator taking care not to lose springs (27) that are in the actuator. Remove upper centering washer (25), upper thrust washers and thrust bearing (20, 21), spacer (19), and gasket (18).

Remove screws holding upper end cover (1) to housing and slide cover off cam shaft (5) taking care not to damage oil seal in counter-bore of upper cover. Remove cam (5) from housing.

INSPECTION

Clean all parts thoroughly in cleaning fluid. Careful visual inspection of the steering gear parts is very important as these visual checks may uncover conditions not evident during operation.

Check the cam groove for damage (chipping, scoring or brinelling). The cam is copper plated for initial service. The operation of the stud in the cam groove will wear away the copper plating. This is a normal condition.

Check condition of bearing surface on O.D. of each end of cam. Check for twisted splines and wear on bearing surfaces of lever shaft and side cover adjustor stud assembly.

Check the lever shaft stud for nicks, flat spots,. and spalling. Check adjustment of stud roller bearing (13). When necessary to replace a stud bearing unit, replace both units. The two studs are matched in height to assure proper contact in the cam lead.

Check end play of adjuster stud assembly (14) in accordance with instructions under "Adjustment". End play may be none (zero) to .003". If disassembly of adjuster stud assembly (14) is necessary, proceed as follows:

Straighten prong of washer. Back off nut and screw tight against retainer to make adjuster stud rigid with retainer. Remove adjuster stud from lever shaft by turning retainer counter-clockwise. Further disassembly of the adjuster stud assembly can be accomplished by unscrewing plug from retainer provided the staking can be removed without damaging the threads. Replacement of the complete adjuster stud assembly (14) is recommended.

Check housing (11) for strain at the mounting flanges. Check condition of cam needle bearings (3) in housing. Check fit of cam in needle bearings. Check bushings (10) in housing for wear or out-of-round. Check lever shaft oil seal (9).

The control valve is the control center of the hydraulic system. The major parts, which are the body and spool, are machined to very close limits and with precision machined edges. The spool and valve body are selectively fitted at the factory according to O.D. of spool and I.D. of body; therefore, these two parts are not separately replaceable.

CAUTION: If either needs replacing, the whole valve assembly must be replaced. Good performance of power steering is not assured if "mismatched" spools and bodies are used.

CAUTION: Care should be exercised in the handling of parts to prevent damage.

Control edges of the valve sleeve and the spool should not be broken. The result would be excessive leakage past the control edges and reduced hydraulic power.

INTERNAL INSPECTION OF VALVE: Remove retainer ring (51), cover plate (50), and O-ring seal (49). Remove end cover (34) and O-ring seals (44) from the valve body. Remove elastic stop nut (35) and washer (36) from end of flexure rod (48) and pull the flexure rod out of spool. Push the spool out in the same direction to permit removal of centering washers (37), and O-ring (38), and centering spring (39).

Remove O-ring (43) from the spool. (Use a pointed instrument but be careful not to damage the seal.) Bypass valve parts: plug assembly (40), spring (41), and ball (42) may be removed if desired. Inspect the spool. Inspect the body internally. Check for scoring by dirt in the system. It is impractical for a field service station to measure wear. Wear should be negligible because the spool operates in circulating oil, therefore, performance should determine serviceability.

OTHER PARTS: Check the steering arm balls and splines in the arm. Make a general inspection of all external parts.

CLEANING

Cleanliness is very important. Use solvent or volatile mineral spirits to clean and wash grease, oil, or dirt from all metal parts of the steering gear. Clean machined parts individually to avoid damage due to "bumping" together of parts. Use lint free cloths, dipped in the cleaning agent, to clean all machined surfaces. After parts are cleaned, dry the parts, except bearings, with dry compressed air. Cleaning solvents or volatile mineral spirits will deteriorate rubber parts.

REASSEMBLY

Refer to Figure 11 - 7.

Replace all gaskets and seals. If needle bearings (3) in housing (11) and end cover (1) have been removed, replace them. Assemble cam (5) in housing (11) and with gasket (4) in place, assemble end cover (1) to the housing. Make sure the cam rotates and oscillates freely in the bearings. Assemble gasket (18) on top of housing. Assemble the actuator assembly on the cam stub shafts and adjust.

First ensure that the threads of the nut and cam shaft are free of interference by running the nut on to the cam shaft using only the fingers to drive the nut. If the nut cannot be driven all the way with finger torque, the threads are fouled and must be cleared with a thread file, wire brush or other means until the nut goes on freely.

Assemble spacer (19) over stub shaft and seat against lower end of cam. Lubricate, then assemble the following parts in order: thrust washer (20), needle thrust bearing (21), thrust washer (20), centering washer (25), actuator (26), springs (27) in actuator, centering washer (25), thrust washer (20), needle bearing (21), thrust washer (20), tongued washer (28), new lockwasher (29) (with thirteen external lugs), and adjusting nut (30).

Adjust and pack the groove in the actuator with semi-fluid grease. Assemble actuator housing (22) over the actuator. Position the actuator housing for location of valve mounting. Assemble retainer screw and washer (24, 23). Be sure that the screw engages the horizontal slot in the actuator.

Assemble gaskets to the faces of the actuator housing. Fasten lower cover (31) and actuator housing (22) to gear housing (11) with long mounting screws.

To assemble the push-pull adjuster in the lever shaft place seat on adjuster stud making sure the dished side contacts the underneath side of the hex head of the stud. Place the adjuster stud, with seat in place, into and through the retainer. Screw the plug tight into retainer so that the adjuster stud is held rigid. Screw the nut on the adjuster stud to within 1/8" of end face of the retainer.

Place the pronged washer on the adjuster stud with the dished side to the nut. Screw the adjuster stud assembly into lever shaft (12) and tight against nut. Be sure the long prong of the washer is in the slot on the end of the lever shaft (12). Tighten the nut to 15 to 20 foot pounds torque. Lock the nut with the prong of the washer that matches flat on one hex of the nut.

CAUTION: Do not use same prong twice. Replace the washer to avoid using the same prong twice.

Back off the plug to permit rotation of the retainer on the adjuster stud. End play may be none (zero) to .003". Stake over the flange of the plug to lock the plug to the slot in the retainer.

To assemble the side cover and lever shaft to the housing, screw the retainer into side cover (16) until the retainer extends 3/4" out of the side cover. Screw retainer counter-clockwise. Screw lock nut on to retainer but do not tighten. Place the side cover gasket (15) on the face of housing (11). Assemble lever shaft (12) in housing (11). Use care not to damage oil seal (9) in the end of the housing trunnion. Engage the taper studs in the groove of cam (5). Position the studs in the cam groove about two cam turns off mid-position. Assemble the side cover to the housing.

To adjust for backlash of taper studs in the cam groove, place steering gear in mid-position, as outlined in "Centering Steering".

Screw the retainer into the side cover until a slight drag is felt when turning the taper studs through the high spot on the cam which is in the area of mid-position of the gear. Back out (counterclockwise) the retainer approximately 1/16 turn to barely eliminate the slight drag over the high spot. Turn the cam from extreme left turn to extreme right turn and reverse to check for tight spots. If no tight spots exist, tighten the lock nut tight.

CONTROL VALVE

REASSEMBLY

Before reassembling, be sure all parts have been thoroughly cleaned. Light lubricating oil should be applied to spool and O-rings.

Assemble O-ring (43) on the spool. Assemble the spool in the valve body. Ensure that the end with the O-ring is toward the clevis end of the valve. When assembling the spool in the body, a twisting motion applied to the spool will be helpful.

Assemble into the body: centering washer (37) spring (39), centering washer (37), O-ring (38) and centering washer (37). Assemble flexure rod (48) in spool. Assemble washer (36) and nut (35) to flexure rod and tighten the nut to 125 - 150 inch pounds torque.

If the bypass valve parts were removed, replace O-ring on plug (40) before reassembling in body. Assemble ball (42), spring (41), and plug (40) in the body. Assemble actuator lever (46) in actuator housing (22) bushing making sure the stud end of the lever seats in the groove of actuator (26) and position the slot in the other end of the lever so that the pin in the clevis of the flexure rod will fit freely when mounting into the valve. Lubricate the actuator lever and bushing.

Mount the valve on the actuator housing making sure that the clevis pin fits freely into the slot of the actuator lever. Start all four mounting screws and tighten lightly in rotation before applying the final tightening torque of 10 - 15 foot pounds. Careless tightening may cause the valve spool to be pulled off center by actuator lever interference with clevis pin.

Be sure that the spool actuates (moves axially in both directions) before assembling the end covers. This can be done as follows: Place the steering gear arm on the lever shaft. Place the steering wheel on the wheel tube. Turn the steering wheel to move the steering arm against a stop. Apply sufficient effort to actuate the spool. Reverse the arm against the opposite stop to actuate the spool in the other direction.

Assemble O-rings (44) on the end of the body and assemble end cover (34) and tighten to the valve body. Assemble O-ring (49, cover plate (50), and retaining rings (51).

INSTALLATION IN CHASSIS

Place the gear in the chassis and bolt securely. Torque two mounting cap screws. Check clearance between upper lug & frame. Add shims if necessary and torque top nut & bolt. Do not spring the cam shaft. FREE ALIGNMENT OF THE SHAFT IS VERY IMPORTANT. Do not force the shaft into a position of misalignment as this will cause binding of the wheel tube and prevent centering of the control valve. The cam and actuator assembly must be free to oscillate axially.

Center the steering gear. Set lever shaft so that the groove cut across end of same is at a 90 ° angle to centre line of steering gear box (as shown in fig. 11 - 6). Install pitman arm on lever shaft of gear in a vertical, or as near to vertical, position as possible. (If necessary adjust drag link length to fit.) With lockwasher and nut in place on end of lever shaft, tighten to specified torque, - 350 foot pounds. Install hydraulic lines.

CAUTION: DON'T hold valve open against stop except momentarily to get pressure readings. Holding valve open more than this will shorten pump life. The pump can be "burned out" quickly.

REMOVAL OF STEERING WHEEL

Set steering wheel in straight ahead position.

1. Remove the emblem, using screwdriver at the notch provided.
2. Disconnect the horn wire.
3. Remove steering wheel retaining nut and then using a suitable puller, pull steering wheel from upper shaft.

REPLACEMENT OF WHEEL

For replacement, reverse removal procedure and torque steering wheel nut to 50 ft. lbs.

REMOVAL OF STEERING COLUMN

1. Disconnect turn signal connector under dash.
2. Remove metal screws attaching floor cover to floor at steering column and remove cover.
3. Remove bolt securing lower universal joint to wheel shaft and bolts attaching steering column to bracket on bottom of dash.
4. The steering column may now be lifted straight up and out of the coach as a complete unit. NOTE: Lower spring bearing and spacer will be free to fall out, unless restrained, when removing column.

For replacement, reverse procedure and refer to torque specifications at the end of this section.

DISASSEMBLY

1. Remove steering wheel (refer to steering wheel removal).
2. Remove four bolts connecting upper and lower halves of universal joint housing.
3. Remove clamp bolt on universal joints through access holes in upper universal joint housing.
4. Remove universal joint assembly from upper and lower wheel shafts, taking care not to let bearing and spacers fall out unnoticed.
5. Pull the bearings and spacers out of the upper and lower housings.

CLEANING

1. Clean all parts by immersing in cleaning solvent. Use a soft bristle brush to loosen deposits of dirt and old lubricant. Repeat immersion and brushing until parts are clean.
2. Wash all bearing assemblies in cleaning solvent and remove all loose particles of dirt by striking the bearing flat against a smooth block of wood.
3. Rinse bearing in cleaning solvent. Hold bearing races to prevent rotation of bearing; then blow bearing dry with compressed air directed at right angles to bearing. Do not spin bearings.

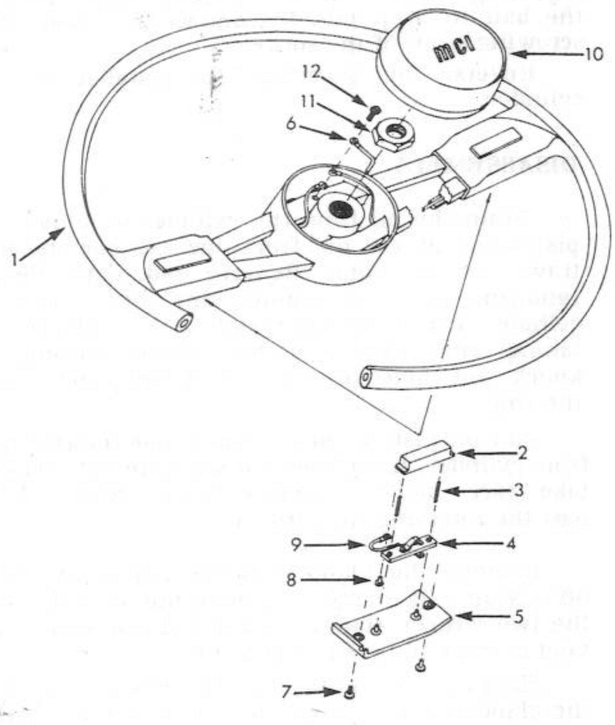
INSPECTION

Inspect shafts, splines, universal joints and all threads for damage. Replace all parts not in good condition.

REASSEMBLY

Saturate upper & lower felt washers #50 oil and pack bearings with #105 Lubriplate.

1. Install felt washer, bearing and bearing spacer in upper joint housing.
2. Insert upper shaft through bearing & joint housing.
3. Assemble lower shaft to universal joint ensuring that through pin for lower flex coupling is parallel to cross on lower section of universal joint.
4. Install spacer collar on lower end of upper shaft and assemble to universal joint.
5. Secure lower jacket tube to joint housing with clamp and assemble to upper joint housing.
6. If horn contact ring & cable have been removed assemble to upper shaft at this point.
7. Install bearing assembly in upper jacket tube and slide over shaft onto upper joint housing. Secure with clamp.



1. Wheel Assy. - Less Horn Button
2. Horn Button
3. Spring
4. Micro Switch Assy.
5. Switch Cover
6. Wire & Terminal Assy.
7. Tapping Screw
8. Screw
9. Wire Assy.
10. Emblem
11. Wheel Nut
12. Screw

Figure II - 5: Steering Wheel Assy.

Alignment of the column is very important. Binding in the column will prevent centering of the control valve in a neutral position. The cam stub shaft must not bind. Shims, as required, are installed in the factory and should be re-used or replaced with shims of same thickness. If column to dash mounting position has been altered in any way use shims as necessary to achieve the desired column alignment.

After coaches with Unit No. 10727, adjust Steering Column Turnbuckle as follows:

1. Remove Steering Column base cover.
2. Adjust turnbuckle until the steering column shaft is centered in the lower portion of the jacket tube.
3. Tighten turnbuckle jam nuts and replace column base cover.
5. After checking ball stud (Note: If out of round, install new parts) assemble drag link to ball studs and turn in the end plug until solid (approx. 20 foot lbs.). Back off end plug to nearest cotter pin hole.
6. Lubricate all parts and re-assemble in reverse order of disassembly.

DRAG LINK

DESCRIPTION

The steering drag link assembly is a three piece type. Consisting of a long tube, socket end which joins to the steering pitman arm and a stud end that joins to the main steering arm at the front axle. A clamp on the socket end is used for positive adjustment lock.

DISASSEMBLY

Drag link must be at least partially disassembled for removal.

1. Remove cotter pins on drag link ends and turn out plug.
2. On socket end, remove cotter pin and unscrew plug, pull out spring and inner ball seats.
3. On stud nut end, remove nut, spring and dust cap.
4. Clean parts in a suitable cleaning fluid and check for wear or damage of any kind. Replace such parts as necessary.
5. After checking ball stud (Note: If out of round, install new parts) assemble drag link to ball studs and turn in the end plug until solid (approx. 20 foot lbs.). Back off end plug to nearest cotter pin hole.
6. Lubricate all parts and re-assemble in reverse order of disassembly.

STEERING BOOSTER CYLINDER

DESCRIPTION

The steering cylinder is a Ross C-44 Series hydraulic cylinder with an integral ball socket. A poppet valve is incorporated in the piston. The poppet valve is held closed by the hydraulic fluid force on the piston. At the end of the stroke the poppet contacts the end of the cylinder and is pushed open allowing fluid to flow through the piston, preventing full hydraulic force at the end of the stroke.

MAINTENANCE

No periodic minor maintenance is required on the cylinder.

REMOVAL AND INSTALLATION

1. Apply parking brake. Turn steering wheel to full left position.
2. Disconnect oil lines from booster. NOTE: Prevent dirt from entering line.
3. Loosen booster cylinder adjusting rod clamp and thread cylinder rod out of ball joint.
4. Remove cotter pin from rear ball joint of booster cylinder and loosen joint plug.
5. Remove booster.
6. For installation reverse procedure of Items 2, 3, 4 and 5.

Cap the fittings on the cylinder to prevent contamination. Remove the cotter pin and loosen the adjusting nut at the ball socket. This will permit the ball to drop out. Disconnect the other end by screwing it out of the socket.

Reverse this procedure for installation of the cylinder.

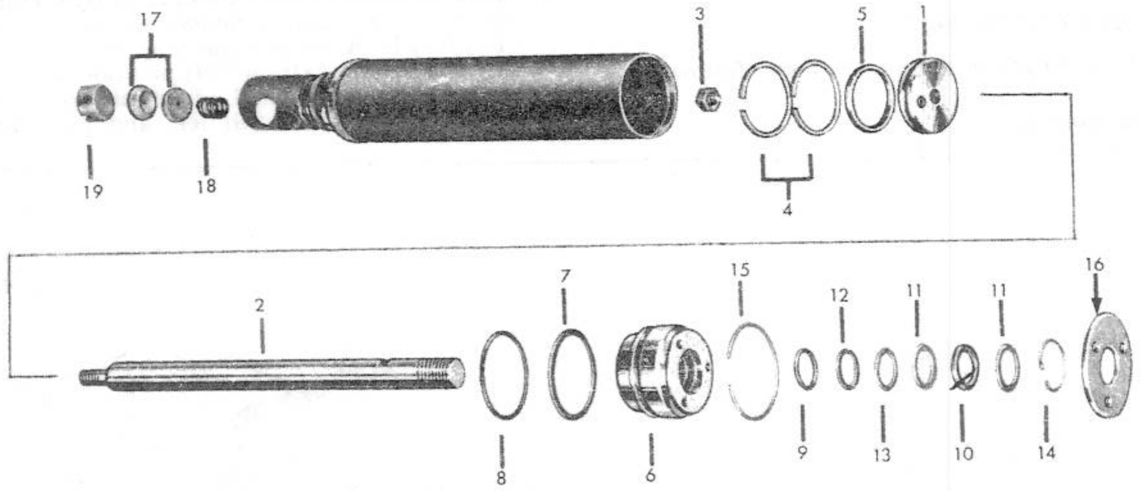
DISASSEMBLY

Drain the oil from the cylinder by moving the piston rod in and out from one extreme end of its travel to the other. Remove end plate. Remove retaining ring. To remove ring push gland into cylinder barrel approximately 1/4", compress retaining ring with a punch entered through the knock out hole of cylinder barrel, and remove the ring.

Pull on piston rod to remove the internal parts from cylinder. If replacement seals are not available, take care not to damage O-ring when sliding past the retaining ring groove.

Remove the gland from the piston rod. (Slide off piston end of rod). Remove nut. (Hold rod by the two wrench flats near outer thread end to prevent damage to finish on rod O.D.)

Slide off piston and remove piston rings. With the gland removed from the rod remove the sealing parts inside the gland by first removing oil seal, and O-ring. From the O.D. of the gland disassemble



1. Piston Assy.
2. Piston Rod
3. Lock Nut
4. Piston Ring
5. Seal
6. Gland Assy.
7. Back-Up Ring
8. "O" Ring
9. "O" Ring
10. Seal
11. Washer
12. Back-Up Ring
13. Washer
14. Retaining Ring
15. Retaining Ring
16. End Cover
17. Ball Seat
18. Spring
19. Adjusting Plug

Figure II - 6: Power Steering Booster Cylinder

O-ring and back-up ring. Check the action of poppet valve for leakage. If not in good condition, replace with a new piston assembly.

Remove the cotter pin and unscrew adjusting plug, remove ball stud and ball seats.

Thoroughly wash all parts and the socket shell with solvent. Examine parts and ball stud for flats, scoring, galls and excessive wear. Replace parts as necessary.

CAUTION: Flats worn on the ball stud can cause binding and erratic steering.

REPAIR

Replace all worn or damaged parts. All old seals and O-rings should be discarded and new ones used when reassembling.

REASSEMBLY

Lubricate all seals and O-rings with light oil before assembling. Assemble O-ring to inside of gland with the sealing lip toward the inside. Assemble back-up ring on O.D. of gland, then O-ring. To prevent damage to rod seal, assemble the gland assembly to the rod from the piston end of the rod. Slide the gland over the rod toward the outer end of the rod, but prevent from sliding over the threads.

Assemble piston rings in the piston ring groove of piston. Assemble piston to the end of rod with nut. Tighten to 100-125 foot pounds torque. (Hold piston rod by wrench flats). Slide the piston into cylinder barrel. Push the assembly into the cylinder half way and slide gland into cylinder taking care not to damage O-ring as it slides past the retaining ring groove in the end of the cylinder. Assemble scraper seal, with the lip out, over the piston rod and into gland. Lock gland in place with retaining ring in the cylinder groove. Check for binding by moving piston rod in and out full stroke. Assemble end plate. (Torque screws to 100-200 inch pounds).

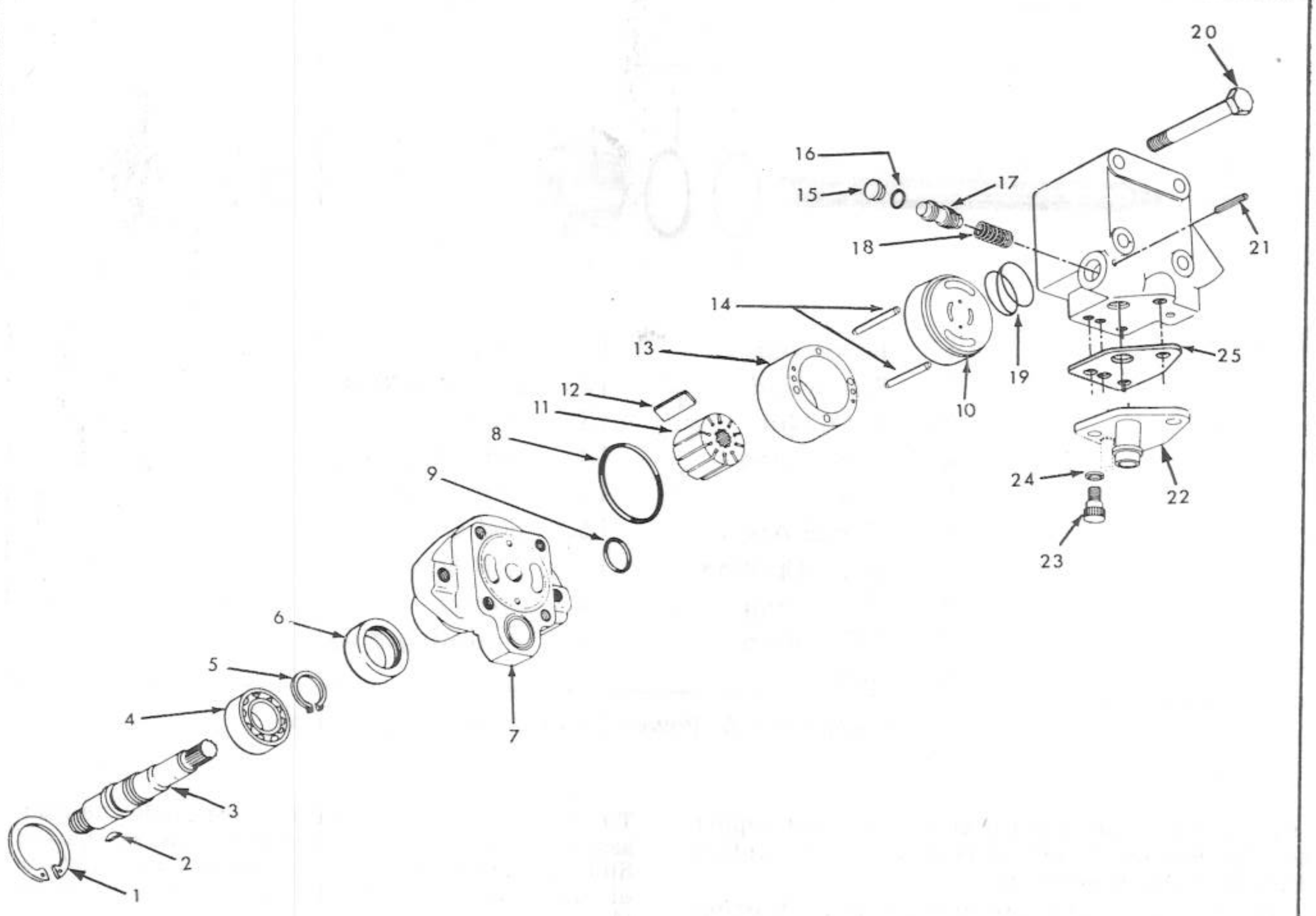
Assemble ball seats and adjusting plug. Insert the lubricated ball stud into the socket opening and tighten the adjusting plug tight until the spring is compressed solid, then back off to the nearest lock point and insert the cotter pin.

NOTE: After complete assembly and installation of the cylinder, lubricate the socket assembly with conventional lubricant.

ADJUSTMENT OF BOOSTER

To adjust length of stroke of booster follow these steps:

1. Jack up front axle.
2. Turn wheel stops on axle all the way in.
3. Make an extreme right hand turn. By turning push rod in or out adjust booster so as to have 1/4" clearance between tire and drag link.
4. Turn wheels to extreme left position. Check clearance between tire and shock absorber. Balance clearances between full left and right turns by.



1. Snap Ring
2. Key
3. Shaft
4. Bearing
5. Snap Ring
6. Shaft Seal
7. Body
8. "O" Ring
9. "O" Ring
10. Pressure Plate
11. Rotor
12. Vane Kit
13. Ring
14. Pin
15. Plug
16. "O" Ring
17. Control Valve S/A
18. Spring
19. Spring
20. Screw
21. Pin
22. Manifold S/A
23. Screw
24. Washer
25. Gasket

Figure II - 7: Power Steering Pump

adjusting booster cylinder push rod.

5. Set wheel stops with .010" clearance at full turn positions.

POWER STEERING PUMP

DESCRIPTION

The power steering pump is gear driven and is mounted on the flywheel housing. It is a balanced vane type with a constant delivery per revolution and a capacity of 4 gallons per minute at idle, and a maximum pump pressure of 1000 lbs. p.s.i.

MAINTENANCE

No periodic maintenance is required on the pump.

REMOVAL AND INSTALLATION

The pump is accessible through the right hand engine compartment door. The pump is removed by disconnecting the outlet hose and removing the inlet at the rubber hose connecting pump inlet to reservoir outlet. Then remove the two mounting bolts. Mounting flange gasket should be replaced whenever pump is removed. To install pump, reverse the above procedure.

DISASSEMBLY

CAUTION: Before removing unit or parts of unit to be serviced, be certain the unit is not subject to hydraulic pressure. During disassembly, special attention should be given to identification of parts for proper reassembly.

Remove the manifold by removing the capscrews, copper washer, manifold and O-rings from the pump cover.

Clamp the pump mounting flange in a machinists vise with protective jaws. Separate the cover from the pump body. Remove the pressure plate spring and pressure plate. Remove the pump ring, locating pins, rotor and vanes, and the two O-rings.

Mount the cover in a vice. Drive out the retaining pin with a pin punch. Protect the relief valve plug and sub-assembly from falling from the bore. Remove the plug, control valve and spring from the bore.

NOTE: Access to the relief valve plug and subassembly may be gained through the large chamfered hole which leads to the relief valve bore from inside the cover.

Inspect the relief valve and bore for wear and scoring. Support the shaft end of the pump body in a two inch straight pipe coupling and, using an arbor press, remove the shaft thrust spacers, outer needle bearing and shaft seal. The shaft assembly should drop through a slot in the press table so that the shaft will not be damaged. The outer needle bearing and shaft seal are a press-fit to the body. Use a pin punch and hammer to tap the inner needle bearing from the body.

INSPECTION AND REPAIR

NOTE: Wash all parts, except seals, in clean mineral solvent and lay them aside for inspection. Replace all old seals and O-rings at reassembly.

Inspect the surfaces of ring, rotor, vanes, pressure plate, and body for wear. Light scoring may be removed from the faces of the body or wear plate with crocus cloth (by placing the cloth on a flat surface), medium India stone or by lapping. Check the edges of vanes for wear. Vanes must not have excessive play in slots or burrs on edges. Replace if necessary. Check each rotor slot for sticky vanes or wear. Vanes should drop in rotor slots by their own weight when both slot and vane are dry.

Insert the relief valve in its bore in pump cover. There should be no binding. Check the valves and bore for excessive wear and scoring. Replace if necessary.

Replace the shaft seal at each overhaul to prevent oil leakage. Check the drive shaft oil seal diameter for wear and scoring. Do not install a new seal on a shaft which is worn or damaged at the oil seal diameter. Replace the shaft if worn. Stone and polish the sharp edges on the shaft to prevent damage to the seal.

Stone all mating surfaces of body and cover with a medium India stone to remove all burrs and sharp edges. Rewash all parts after stoning.

REASSEMBLY

NOTE: Immerse all parts in clean engine oil prior to reassembly.

Starting with the shaft end, press the inner needle bearing in the body using an arbor press. Assemble the split-ring thrust spacer on the shoulder portion of the shaft and install the shaft in the pump body.

Press the outer bearing onto the shaft. The edge of the bearing must be 1/64" below the shaft seal shoulder when assembled. This provides for shaft end play of .010" to .015".

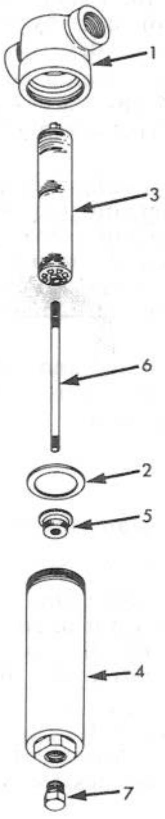
NOTE: Tools for installing bearings can be made from round stock with an outside diameter slightly smaller than that of the bearing and the inside diameter slightly larger than the shaft diameter. Do not score or damage the shaft during this operation.

Position the seal on the shaft end of the body, being careful not to damage the seal. Using the special tool, press the seal in until it engages the shoulder in the body. This shoulder acts as a positive stop for the seal. Do not over-press as this will result in damage to the seal.

Install the locating pins in the pump body. Install the ring over the pins according to the correct direction of rotation. Install the rotor with the chamfered edge of the splined hole "in" toward the pump body. Install the vanes with their radius edge toward the inner ring contour. Oil the cartridge with clean engine oil and install the pressure plate. Install the o-rings, pressure plate spring and cover. Tighten the cover screws to 25-30 foot pounds torque.

Install the pressure compensating spring in the relief valve bore. Insert the valve assembly with the hex toward the spring. Insert the valve assembly with the O-ring in the bore and hold it in position while driving a new retaining pin.

Install the O-rings in the pump cover and secure the manifold to the pump body with screws. The copper washer is used on the screw where the tapped hole enters the oil passage.



1. Filter Head
2. Gasket
3. Element
4. Bowl
5. Nut
6. Stud
7. Pipe Plug

Fig. 11-8A - Power Steering Filter (Pressure)

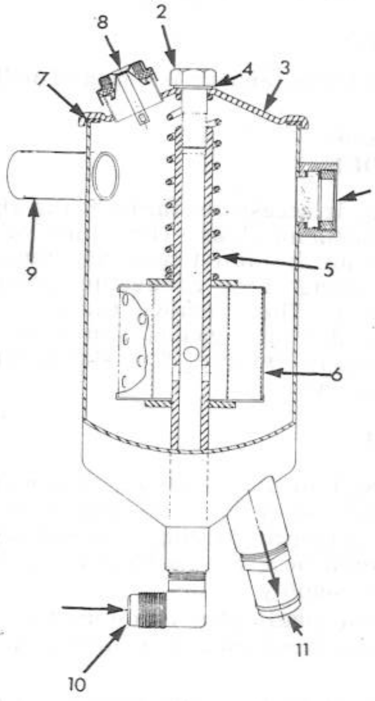
POWER STEERING FILTER (Pressure)

The power steering filter is located in the right hand front engine compartment. This is a pressure line filter. At regular intervals or 50,000 miles, the filter should be removed and cleaned. Note: This filter should be cleaned in conjunction with servicing and replacing the reservoir filter element. The power steering system should be bled at this time.

Servicing Filter

The filter can be serviced without removing it from coach.

1. To service filter remove bowl by applying wrench at flats.
2. Remove and discard filter bowl gasket.
3. Remove filter retaining nut and carefully remove element. Avoid damage to element. Clean parts in solvent and dry with compressed air.
4. Clean bowl and install element and bowl with new gasket. Tighten bowl. (Bleed Power Steering system and check for leaks at bowl & body.)



1 Sight Glass
2 Cover Bolt
3 Cover
4 Gasket
5 Spring
6 Element
7 Gasket
8 Breather Cap
9 Filler Inlet
10 Return Inlet
11 Feed Outlet

Fig. 11-8B - Power Steering Reservoir & Filter

POWER STEERING RESERVOIR & FILTER

A power steering fill, reservoir and sight gauge are located in the upper right hand side of engine compartment. It is recommended that the filter element be serviced at the same intervals as cleaning the Power Steering Pressure Filter Element, approximately 50,000 miles, depending on operating conditions. When replacing the element refer to the cross sectional view. Note, after new element and gaskets are installed, install cover and bolt assembly. Check for leaks after operating system.

MAJOR INSPECTION & MAINTENANCE

As a SAFETY PRECAUTION, it is the manufacturers recommendation that at major inspections or every 300,000 miles depending on operating conditions, that the front end steering components be magnaflux or magnaglo inspected. This also applies when purchasing a used coach. This recommendation is due to various hazards while coach is in service, such as extreme rough road surface, curbing of tires or accidents. In some instances at disassembly of steering components damage may also be caused due to heavy hammering or application of heat.

Important steering parts to be magnaflux or magnaglo inspected are:

(a) Pitman Arm
(b) Drag Link Ends
(c) All Ball Studs
(d) Cross Tube End Steering Arms
(e) Main Steering Arm
(f) Lever Shaft (Sector)
(g) Worm Shaft
(h) Axle Spindles

Other components being visually inspected that may be doubtful should also be included in the magnaflux or magnaglo inspection.

When inspecting the steering components, DO NOT NEGLECT THE MAGNAFLUX OR MAGNAGLO METHOD OF INSPECTION.

DO NOT UTILIZE ANY METHODS FOR REPAIR ON STEERING COMPONENTS SUCH AS WELDING, METAL PLATING, ETC., REPLACE WITH GENUINE NEW PARTS.

TROUBLESHOOTING

Trouble	Cause	Remedy
Pump not delivering oil.	Driven in wrong direction of rotation.	Check direction of pump shaft rotation.
	Pump drive shaft disengaged or sheared.	Remove pump; determine damage to cartridge parts (see disassembly instructions) replace sheared shaft and needed parts.
	Flow control valve stuck open.	Disassemble pump & wash control valve in a clean solvent. Return valve to its bore and slide it back & forth. No stickiness in movement should occur. If a gritty feeling is noted on the valve O.D., it may be polished with crocus cloth. Avoid removal of excess material or rounding of valve edges during this operation. Do not attempt to polish the valve bore. Wash all parts before reassembly of pump. Flush entire system thoroughly & fill with clean oil as recommended.
	Vane(s) stuck in rotor slots.	Disassemble pump, examine roter slots for dirt, grime or small metal chips. Clean roter & vanes in a good grade solvent (mineral spirits or kerosene) reassemble parts & check for free vane movement.

	Oil viscosity too heavy to prime.	Use fluid of the proper viscosity as recommended.
	Pump intake partially blocked.	Drain system completely; flush to clear pump passages. Flush and refill system with clean oil as recommended.
	Air vent for oil tank clogged or dirty strainer.	Remove filler cap and clean air vent slot. Check filter or strainer in tank for clogged condition. Drain, flush and add clean oil to system if strainer was clogged.
Pumps making noise.	Restricted or partially clogged intake line or clogged filter.	Pump must receive intake oil freely or cavitation will result. Drain system, and clean intake line & strainers. Add new oil and strain by recommended procedures.
	Air leak at pump intake piping joints or pump shaft seal.	Test by pouring oil on joints and around drive shaft. Listen for change in operation. Tighten joints affected and replace pump drive shaft seal according to service instructions.
	Coupling misalignment.	Re-align and replace oil seal and bearings if damaged by shaft misalignment.
	Reservoir or manifold seal leakage.	Leakage between manifold or reservoir at replenishing hole due to O-ring damage. The reservoir inlet tube to pump cover O-ring should be carefully examined for damage such as cuts, nicks or dirt.
Hard Steering either while parking or existing all the time.	Insufficient pump pressure.	Check pump pressure with gauge. If insufficient, check for cause - sticky relief valve in pump or flow control, defective pump.
	Sticky relief valve in pump or flow control. (Prevents pressure build up.)	Replace relief valve - may require total replacement.
	Low fluid level. (Loss of oil due to leaks or damaged lines.)	Repair to eliminate leaks and refill system and reservoir.
	Spool in valve sticking.	Disassemble valve and inspect for sticking. Clean. Reassemble valve or replace & reinstall on gear. Check

		for equal amount ot movement of spool each way from center.
	Wear of actuator lever in bushing of valve mounting bracket or actuator.	Replace actuator lever and possibly bracket with bushing or actuator with bushing.
	Cam stub shaft bent or sprung.	Replace bent parts and correct column alignment.
	Bind of cam in needle bearings.	Eliminate cause of bind.
	Improper front end alignment.	Align to specifications.
	Taper studs adjusted too tight in cam groove.	Adjust.
	Broken piston or piston rings in power cylinder.	Replace. Check condition of cylinder wall.
	Lack of steering gear lubricant	Add lube to proper level.
	Low tire pressure.	Inflate to proper pressure.
	Too much friction in system.	Lubricate and check for binding.
Hard Steering occurring only part of the time	Insufficient hydraulic pressure.	See above.
	Air in system.	See "Bleeding" procedure.
	Loose or too tight linkage connections.	Adjust where necessary.
	Improper steering gear adjustment.	See instructions on adjustment.
	Insufficient oil flow.	Check for damaged hoses, weak or sticking valve springs, or worn pump parts.
Hard Steering in one direction or certain position.	Bent booster cylinder piston rod.	Replace or Service.
	Bind in mechanical section.	Raise front of coach and check moving parts.
"Lumpy" feeling (Momentary spots of hard steering)	This indicates a delay in power application.	Check for excessive free play in mechanical parts.
	Air in oil.	Bleed system as per previous instructions.
	Loose joints or linkage.	Adjust where necessary.
	Insufficient oil flow.	
	Low oil supply.	Check level and refill if necessary.
Hard Steering accompanied by abnormal noise.	Air in system.	Bleed as per instructions.
	Pump malfunction.	See Pump Repair Section.
	Low oil supply.	See above.
Other causes of Hard Steering.	Valve loose on mounting.	Tighten.
	Damaged Booster cylinder	See disassembly and repair of

TROUBLESHOOTING (Cont'd.)

	relief valve.	Booster cylinder.
	Booster cylinder worn or damaged.	See disassembly and repair of Booster cylinder.
No recovery from turn to straight-ahead.	Insufficient caster.	Increase caster.
	Tight ball socket connections & other linkage connections.	Loosen connections but keep them snug.
	Tight front axle spindles.	Make free.
	Bind of cam shaft (prevents centering of valve).	Eliminate bind.
	Bind of cam in needle bearing (prevents centering of valve).	Eliminate cause of bind.
	Spool in valve sticking (prevents centering of valve).	Disassemble valve and inspect for sticking. Clean. Reassemble valve or replace & reinstall on gear.
	Taper studs adjusted too tight in cam groove.	Adjust.
Shimmy	Loose ball socket connections or other linkage connections.	Tighten.
	Wheels out of balance.	Balance.
	Badly worn and unevenly worn tires.	Replace.
	Excessive caster.	Correct and have front alignment checked to specifications.

SPECIFICATIONS

POWER STEERING

Make	Ross Gear
Type	Cam & Lever
Model	HPS 72
Ratio	28:1
Lever Shaft Bearings	Bushings
I.D.	1.7485 - 1.7495
O.D.	2.1275 - 2.1270
Width	1.240 - 1.260
Cam Radial Bearings	Needle
Cam Thrust Bearings	Needle
Cam Bearing Adjustment Type	Bearing Nut
Cam Bearing Shims	None used
End Play in Cam	.100
Pull to keep Cam moving	Max. 4 inch lbs.
Lever shaft adjustment	Thread screw "Push-Pull"
Pull through centre	Nil over and above that required to move cam.
Lever shaft nut torque	350 ft. lbs.
Hydraulic System Capacity (Power Steering)	U.S. 7.5 qts. Imp. 6 qts.

POWER STEERING PUMP

Make	Vickers
Model	VTM - 27 - 40 - 55 - 10 - ME - R1 - 12 - S4
Type	Vane
Rotation	Clockwise (viewed from shaft end)
Location	Mounted on flywheel hsg.
Maximum output pressure	1000 p.s.i.

ROTOR

Width	0.7695/0.7693 in.
Outside Diameter	1.598/1.593
No. Vane Slots	10
Vane Slot Width	0.0785/0.0780 in.

ROTOR VANES

Quantity	10
Thickness	0.0775/0.0770 in.
Width	0.343 in.
Length	0.7692/0.7689 in.

OUTER BEARING

Type	Needle Roller (Radial)
Outside Diameter	1.125 Nom. D.
Inside Diameter	0.875 Nom. D.

INNER BEARING

Type	Needle Roller
Outside Diameter	0.7500/0.7496 D.
Inside Diameter	0.5620/0.5616 D.

FLOW CONTROL VALVE

Opening Pressure	1000 PSI
Shim Thickness	Pt. No. 169932 0.015 in. Pt. No. 169924 0.030 in. Pt. No. 232790 0.010 in.

FLOW CONTROL VALVE SPRING

Free Length	0.820 in.
Compressed Length	Under 14.5 lbs. = 0.627 in. Under 16.4 lbs. = 0.601 in.
Rate	75 lbs. per in. between loads.

RELIEF SPRING

Free Length	2.5468 in.
Compressed Length	Under 6.25 lbs.=1.2968 in. Under 8.2 lbs.=0.9062 in.

Rate 5 lbs. per inch

POWER STEERING VALVE

Make	Ross
Model	V-14
Location	Bottom of, steering gear housing.

POWER STEERING BOOSTER CYLINDER

Make	Ross Gear
Model	C 44
Type	Double-acting
Adjustable Length (Disconnected & Fully Retracted)	17-3/8
Center of Stud at each end	
Cylinder Tube - Inside Diameter (Low Limit Preferred)	2.744/2.750
Outside Diameter	3-1/8
Length	11-7/16
Piston	
Outside Diameter	2.737/2.735
Clearance - Piston to Cylinder	.007/.015
Ring Groove - Width	.1275/.1255
Depth	.1471/. 141
Piston Ring	
Width	.1240/.1235
Wall Thickness	. 127/. 117
Outside Diameter (When Compressed)	
Cap (When compressed to 2.750")	.021/.028
Piston Rod	
Finish	Chrome .0003/.0005 thick
Stroke	7.75
Diameter	.9980/.9966
Piston Rod Bushing (In Cylinder Cap)	
Inside Diameter	.9983/.9990
Outside Diameter	2.742/2.738
Width	2-7/32+.010

POWER STEERING RESERVOIR

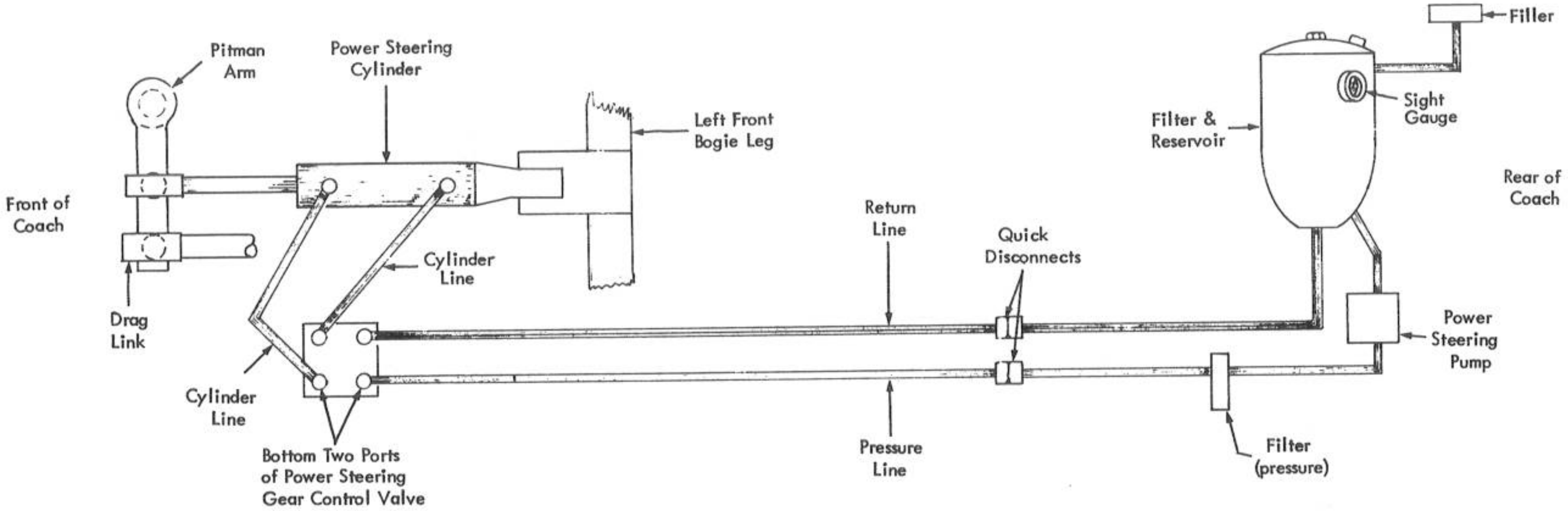
Reservoir make	Walker
Model	317800
Location	Mounted on engine

POWER STEERING FILTER

Make	Zenith
Model	F490-1
Location	At front R.H. engine compartment.

TORQUE SPECIFICATIONS

Steering Wheel Nut	50 ft. lbs.
Steering Gear Mtg.	
Capscrews & Nuts ... Capscrews	100 ft. lbs.
Nuts	130 ft. lbs.
Pitman Drop Arm Lever Shaft Nut	350 ft. lbs.
Cylinder Socket Clamp Bolt Nut	45-50 ft. lbs.
Drag Link End Clamp Bolt	55-65ft. lbs.
Tie Rod End Ball Studs	165-180 ft. lbs.
Cylinder Anchor Plate (Bogie Leg)	45-50 ft. lbs.
Cylinder Ball Stud Nut	120-130 ft. lbs.
Steering Arm Ball Stud Nut	165-180 ft. lbs.
Center Column Universal Joint Clamp Nut	30-35 ft. lbs.
Lower Universal Steering Clamp Nut (Floor Level)	55-60 ft. lbs.
Drag Link Lock Clamp Bolt Nut	100 ft. lbs.


Pitman Arm
Power Steering Cylinder
Left Front Bogie Leg
Filler
Sight Gauge
Filter & Reservoir
Front of Coach
Rear of Coach
Return Line
Quick Disconnects
Cylinder Line
Drag Link
Power Steering Pump
Cylinder Line
Bottom Two Ports of Power Steering Gear Control Valve
Pressure Line
Filter (pressure)

MODEL MC-7

HYDRAULIC POWER STEERING SYSTEM

APRIL 30, 1971

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject
	April 90	New power steering pumps

SUSPENSION

DESCRIPTION

The coach is provided with an air suspension system. The system consists of air beams, air bellows, height control valves, radius rods, and shock absorbers. The system is entirely automatic in operation and is designed to maintain a constant vehicle height regardless of loading. Rear trailing wheels use rolling-lobe type bellows. Air pressure in these bellows is controlled by a pressure regulating valve which maintains constant pressure in bellows and uniform loading of the rear trailing wheels regardless of total vehicle loading.

Air beams are used to provide a larger volume of air for better ride characteristics. Two such beams are located above the front and rear axle as part of the coach body structure.

Suspension bellows assemblies are made from a special compound rubber and nylon tire fabric, and moulded to the proper contour and dimensions. The entire vertical load of the coach is taken by these bellows. Bellows are attached to both the axle supports and air beams by bead rings and special bolts, forming an air-tight seal.

Radius rods are used to hold the axles in the proper transverse and longitudinal position. Four radius rods are used at the rear axle and five at the front axle. These rods transmit both braking and driving forces from the axles to the coach body.

Delay-type height control valves increase or decrease the air pressure in the air beams as required. Two height control valves are located at the rear axle, and one at the front axle. The valves are mounted on the coach body and are connected to the axles by rubber-bushed links. Because of the delay mechanism in each height control valve, the valves respond only to sustained variations in the height of the axles in relationship to the coach body. Thus no change in air pressure takes place during normal driving. However, the valves automatically regulate air pressure in the air beams to compensate for changes in the load carried by the coach, or due to changes in the location of the coach load.

Double-acting shock absorbers are used to improve ride characteristics. Two shock absorbers are used at the front axle, four at the rear and two at the rear trailing wheels.

An auxiliary air system is provided to supply compressed air for the operation of the system. Compressed air from the main system is fed to an auxiliary tank.

MAINTENANCE

The suspension system requires no periodic lubrication except at the rear trailing axle trunnions. These should be greased using a molybdenum disulfide grease. Refer to "Lubrication" (Section 10) of this manual. Routine maintenance should also include usual inspection procedures, and occasional tests to determine that correct coach body height is being maintained.

FRONT AXLE

REMOVAL AND REPLACEMENT

To remove the entire front axle asembly, first block the rear wheels to prevent the vehicle from rolling. Raise the front end of the coach until the bottom of the coach body is approximately 18" from the floor. Block the body in this position as indicated in Section 3 (Body) under "Coach Jacking Points."

CAUTION Do not raise the body in such a way that the entire weight of the front axle will hang on the suspension bellows assemblies. Otherwise damage to the bellows may result.

Exhaust air pressure from the suspension air tank by opening the drain cock at the bottom of air filter. Disconnect the height control valve link, and pull down on height control valve arm to exhaust air from the front inner beams. Disconect the hose from the front brake chambers. Disconnect the steering drag link.

Disconnect both ends of all radius rods as outlined later in this section under "Radius Rods".

Remove nuts from all bolts attaching air bellows lower bead rings to suspension supports. Remove shock absorbers as outlined later in this section under "Shock Absorbers".

Lower the axle assembly on jacks until bellows bead ring bolts are cleared of the suspension supports. The axle can now be carefully removed from under the vehicle.

Reinstallation of the axle assembly is the reverse of removal. Make sure that bellows mounting pads on suspension supports are clean.

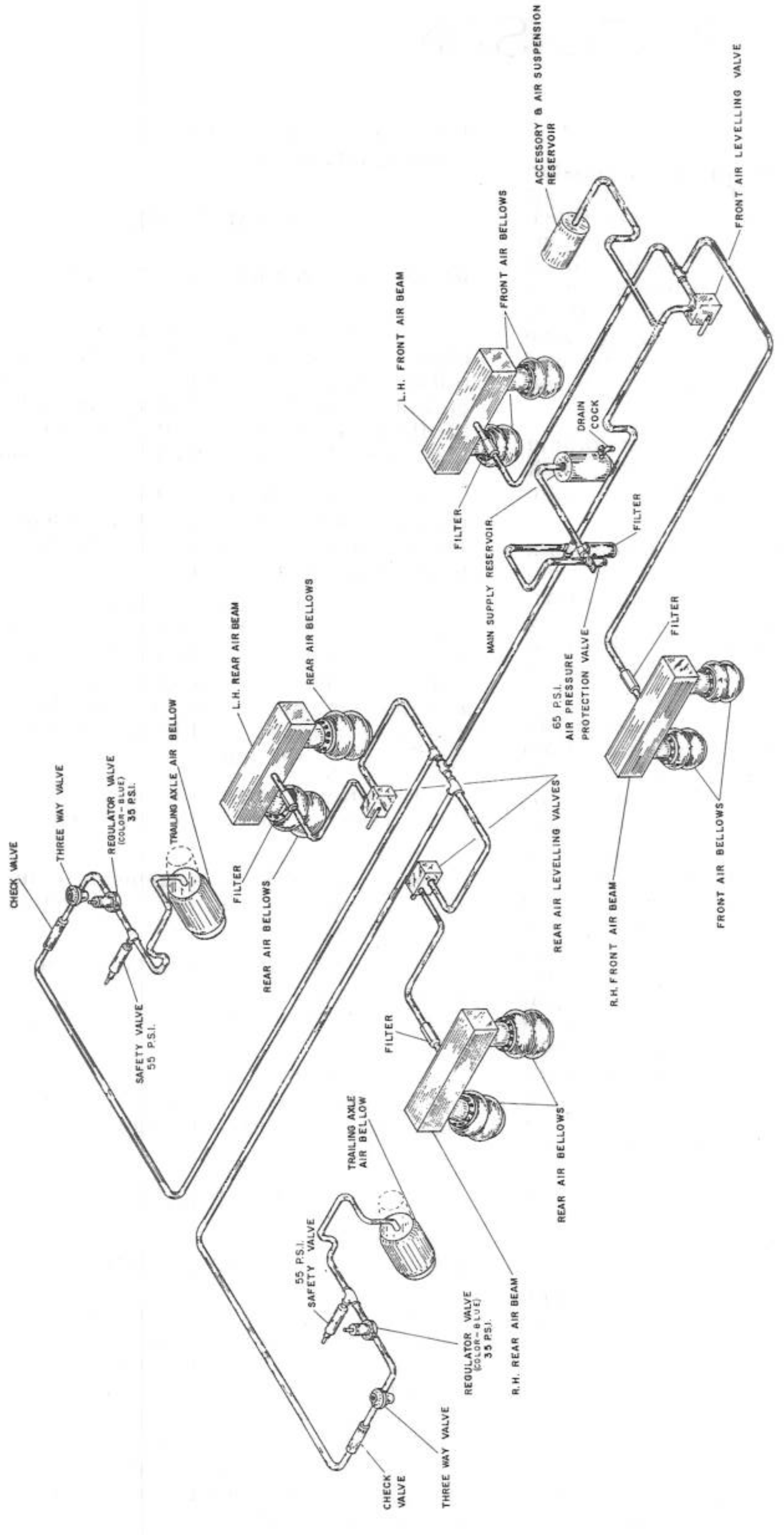
REAR AXLE

REMOVAL AND REPLACEMENT

Block front wheels of the coach to prevent rolling. Raise the rear end of the vehicle with jacks until the bottom of the body is approximately 18" from the floor. Block the body in this position as outlined in Section 3 (Body) under "Coach Jacking Points".

CAUTION Do not allow the rear axle assembly to hang on the bellows, otherwise damage to the bellows may result.

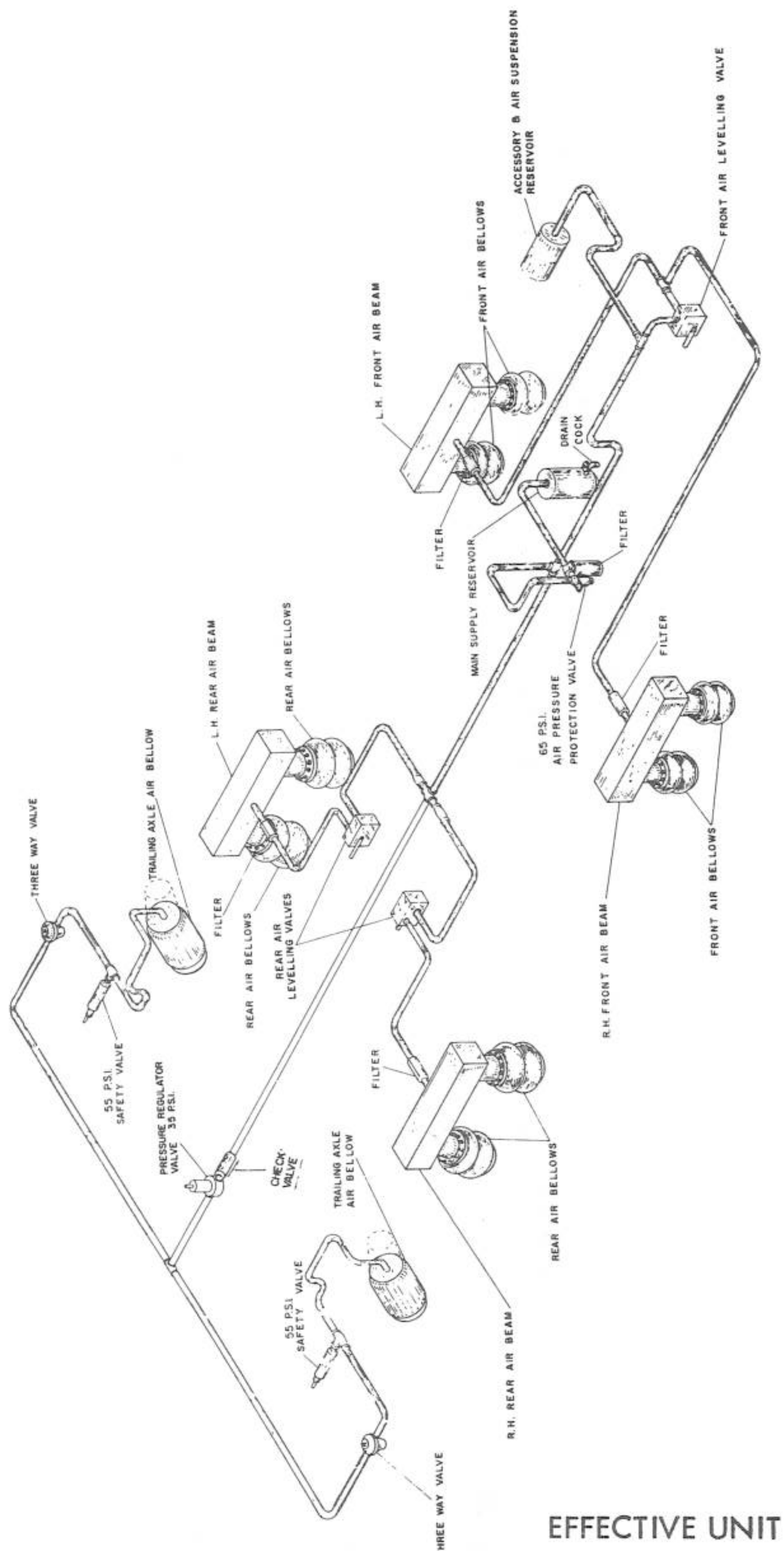
Exhaust air pressure from the suspension system air tank by opening the drain cock on the bottom of air filter.


ACCESSORY & AIR SUSPENSION RESERVOIR
FRONT AIR LEVELLING VALVE
FRONT AIR BELLOWS
L.H. FRONT AIR BEAM
DRAIN COCK
FILTER
MAIN SUPPLY RESERVOIR
FILTER
FILTER
65 P.S.I. AIR PRESSURE PROTECTION VALVE
L.H. REAR AIR BEAM
REAR AIR BELLOWS
TRAILING AXLE AIR BELLOW
REGULATOR VALVE (COLOR-BLUE) 35 P.S.I.
THREE WAY VALVE
CHECK VALVE
SAFETY VALVE 55 P.S.I.
FILTER
REAR AIR BELLOWS
REAR AIR LEVELLING VALVES
R.H. FRONT AIR BEAM
FRONT AIR BELLOWS
FILTER
TRAILING AXLE AIR BELLOW
REAR AIR BELLOWS
55 P.S.I. SAFETY VALVE
REGULATOR VALVE (COLOR-BLUE) 35 P.S.I.
R.H. REAR AIR BEAM
CHECK VALVE
THREE WAY VALVE

EFFECTIVE UNIT NO. 10001 THRU 11028

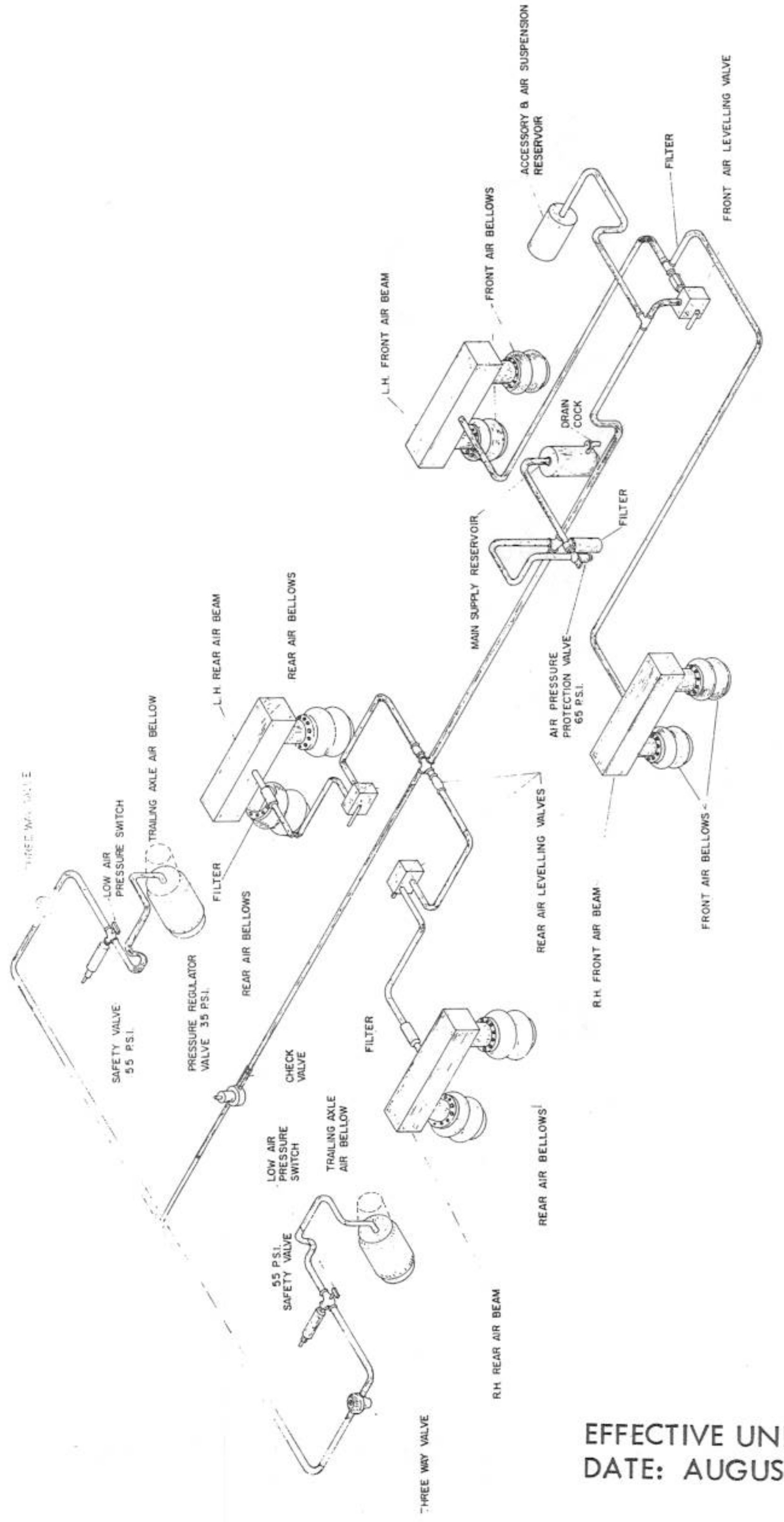
DATE: DECEMBER 3, 1968

Figure 12-1: Suspension System


ACCESSORY & AIR SUSPENSION RESERVOIR
FRONT AIR LEVELLING VALVE
FRONT AIR BELLOWS
L.H. FRONT AIR BEAM
DRAIN COCK
FILTER
MAIN SUPPLY RESERVOIR
FILTER
65 P.S.I. AIR PRESSURE PROTECTION VALVE
FILTER
L.H. REAR AIR BEAM
REAR AIR BELLOWS
TRAILING AXLE AIR BELLOW
THREE WAY VALVE
FILTER
REAR AIR BELLOWS
REAR AIR LEVELLING VALVES
FRONT AIR BELLOWS
R.H. FRONT AIR BEAM
55 P.S.I. SAFETY VALVE
PRESSURE REGULATOR VALVE 35 P.S.I.
CHECK VALVE
FILTER
TRAILING AXLE AIR BELLOW
REAR AIR BELLOWS
R.H. REAR AIR BEAM
55 P.S.I. SAFETY VALVE
THREE WAY VALVE

EFFECTIVE UNIT NO. 11029 thru 12402
DATE: AUGUST, 1974

Figure 12-1A: Suspension System


ACCESSORY & AIR SUSPENSION RESERVOIR
FRONT AIR LEVELLING VALVE
FILTER
FRONT AIR BELLOWS
L.H. FRONT AIR BEAM
DRAIN COCK
FILTER
MAIN SUPPLY RESERVOIR
AIR PRESSURE PROTECTION VALVE 65 P.S.I.
REAR AIR BELLOWS
L.H. REAR AIR BEAM
TRAILING AXLE AIR BELLOW
LOW AIR PRESSURE SWITCH
THREE WAY VALVE
FILTER
REAR AIR BELLOWS
SAFETY VALVE 55 P.S.I.
PRESSURE REGULATOR VALVE 35 P.S.I.
CHECK VALVE
FILTER
REAR AIR LEVELLING VALVES
R.H. FRONT AIR BEAM
FRONT AIR BELLOWS
LOW AIR PRESSURE SWITCH
TRAILING AXLE AIR BELLOW
REAR AIR BELLOWS
55 P.S.I. SAFETY VALVE
R.H. REAR AIR BEAM
THREE WAY VALVE

EFFECTIVE UNIT NO. 12403 thru 12550
DATE: AUGUST, 1974

Figure 12-1B: Suspension System

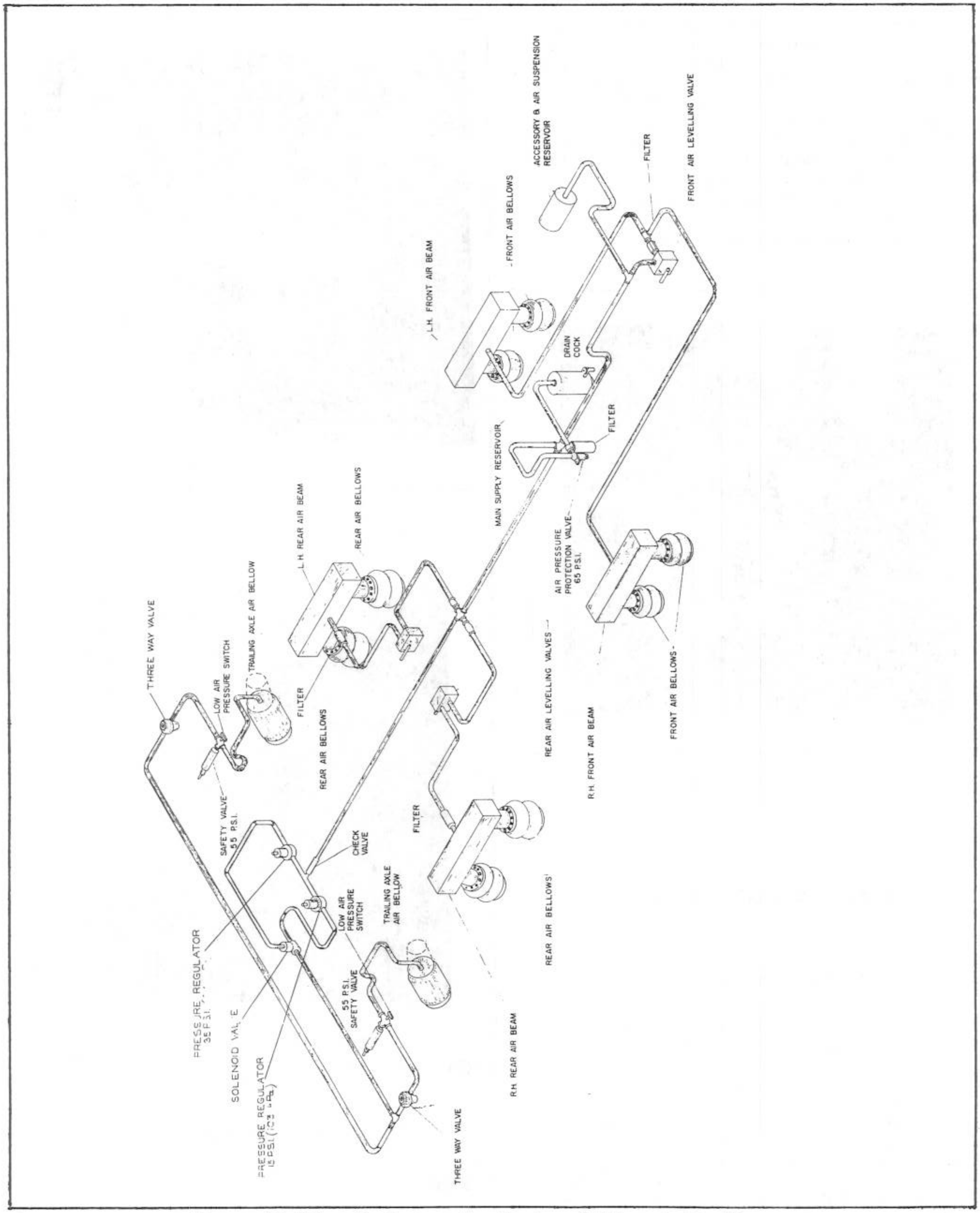

THREE WAY VALVE
PRESSURE REGULATOR 35 P.S.I.
SOLENOID VALVE
PRESSURE REGULATOR 15 P.S.I. (103 kPa)
SAFETY VALVE 55 P.S.I.
LOW AIR PRESSURE SWITCH
TRAILING AXLE AIR BELLOW
FILTER
L.H. REAR AIR BEAM
REAR AIR BELLOWS
REAR AIR BELLOWS
55 P.S.I. SAFETY VALVE
LOW AIR PRESSURE SWITCH
CHECK VALVE
TRAILING AXLE AIR BELLOW
FILTER
L.H. FRONT AIR BEAM
THREE WAY VALVE
R.H. REAR AIR BEAM
FRONT AIR BELLOWS
MAIN SUPPLY RESERVOIR
ACCESSORY & AIR SUSPENSION RESERVOIR
REAR AIR BELLOWS
REAR AIR LEVELLING VALVES
AIR PRESSURE PROTECTION VALVE 65 P.S.I.
DRAIN COCK
R.H. FRONT AIR BEAM
FILTER
FILTER
FRONT AIR BELLOWS
FRONT AIR LEVELLING VALVE

Figure 12-1C: Air Suspension System (With opt. Trailing Axle Unloading System)

Disconnect brake chamber hoses. Disconnect the propellor shaft as outlined in Section 14 (Propellor Shaft). Disconnect both height control valve links from brackets, and pull down on each height control valve arm to exhaust air from the air beam.

Disconnect both ends of all four radius rods as outlined later in this section under "Radius Rods". Remove shock absorbers. Remove nuts attaching the air bellows to the suspension supports.

Lower the axle and carefully remove from under the coach body.

Replacement is the reverse of removal.

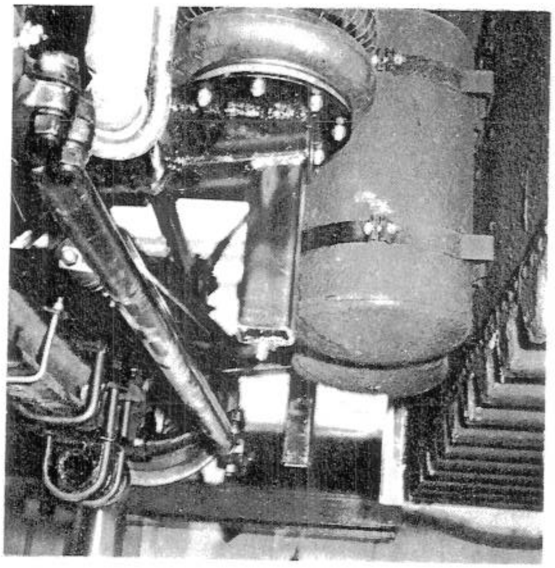


FIGURE 12 - 2: Front Jacking Points

REAR TRAILING WHEELS

REMOVAL AND REPLACEMENT

Rear trailing wheels are carried on independent oscillating axle units, one for each wheel, attached to an axle tube located behind the rear driving axle.

To remove the right or left trailing axle assembly, exhaust air from suspension bellows using the valve provided. Disconnect hose from the brake chamber. Remove wheel. Remove the clamp which retains the axle assembly to the axle tube. Remove screws holding the bellows to the bellows support plate. Slide trailing axle assembly off cross tube bearing.

Reinstallation is the reverse of removal.

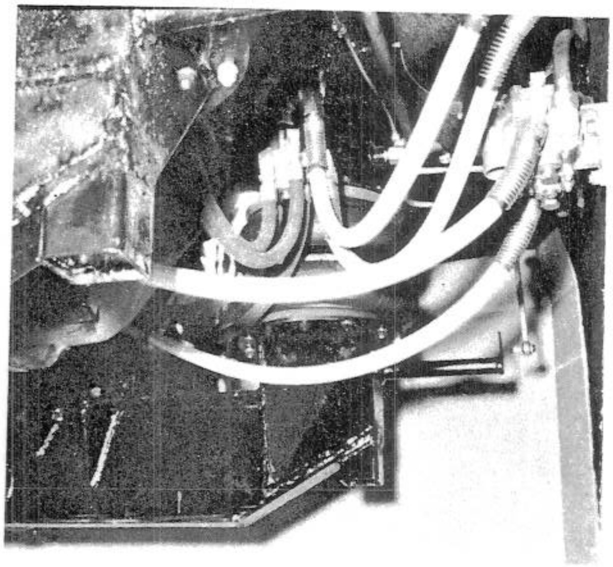


FIGURE 12 - 3: Rear Jacking Points

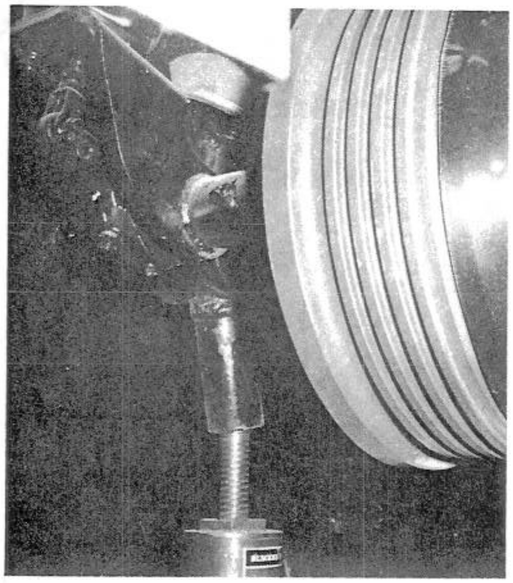


FIGURE 12-3A: Trailing Axle Jacking Point

BELLOWS ASSEMBLIES

DESCRIPTION

Bellows used at the front and rear driving axle are of the double-convolution type, having beads reinforced at top and bottom with wire. Bead rings are specially formed and use special bolts. The surface of the bead ring and bolts are so designed as to prevent any chafing of the bellows. A girdle ring is molded in the center section of the bellows for reinforcement.

Rear trailing axle bellows are of the rolling-lobe (involute) type. The bellow is made of molded rubber and consists of an outer section and a smaller inner, or piston, section which moves vertically.

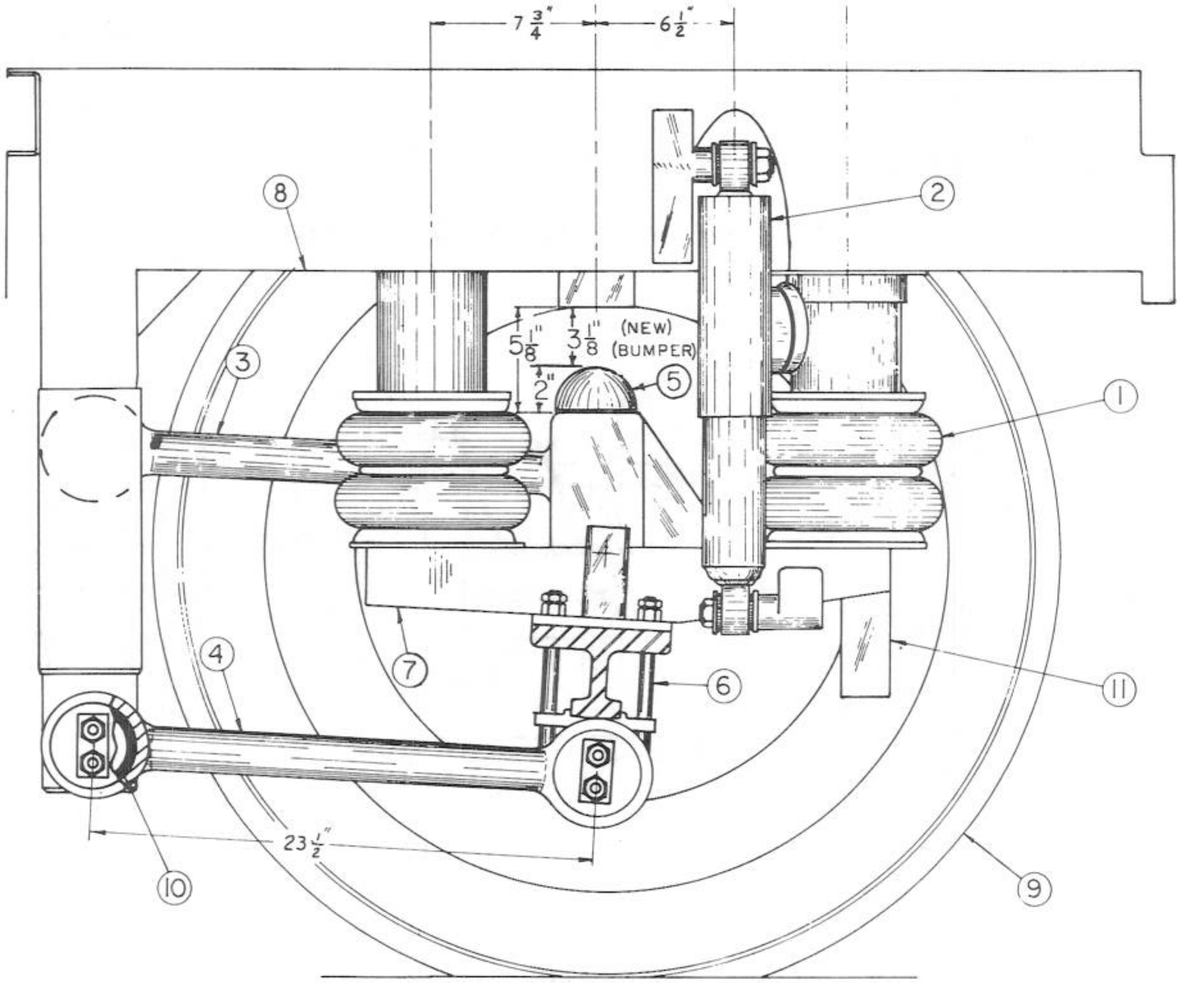
REMOVAL AND REPLACEMENT

Suspension bellows may be removed without removing the entire axle assembly. To do this, raise and block the coach body as outlined under "Axle Removal and Replacement" earlier in this section. Disconnect height control valve link and pull down on valve arm to exhaust air from the air beam.

Remove nuts and washers from upper and lower bead ring bolts. Separate bellows bead rings from suspension support and air beam tube flange and remove bellows.

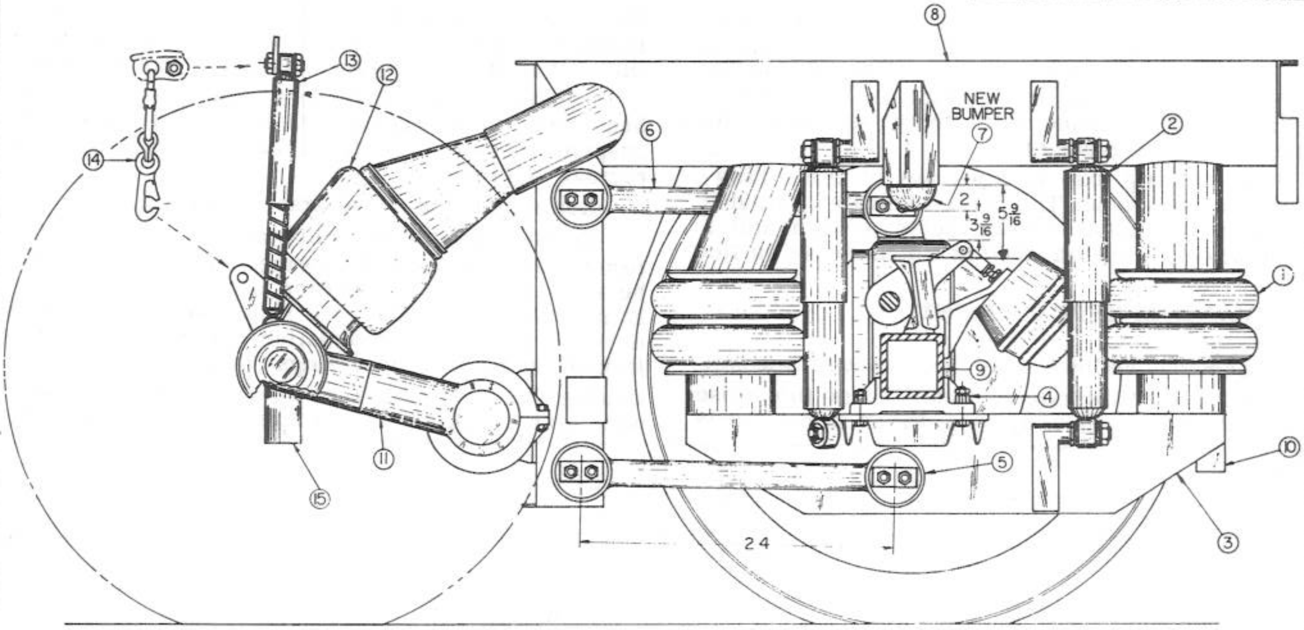
Replacement is the reverse of removal.

Bellows should be examined for punctures, deterioration, cracks and chafing. Bead rings should be examined for deformation or sharp edges. If in satisfactory condition, bead rings can be used with new bellows. After installation, check carefully for leakage at bellows bead rings. This can be done by coating the area around the bead ring with soap and water and checking for any sign of bubbles. Tighten

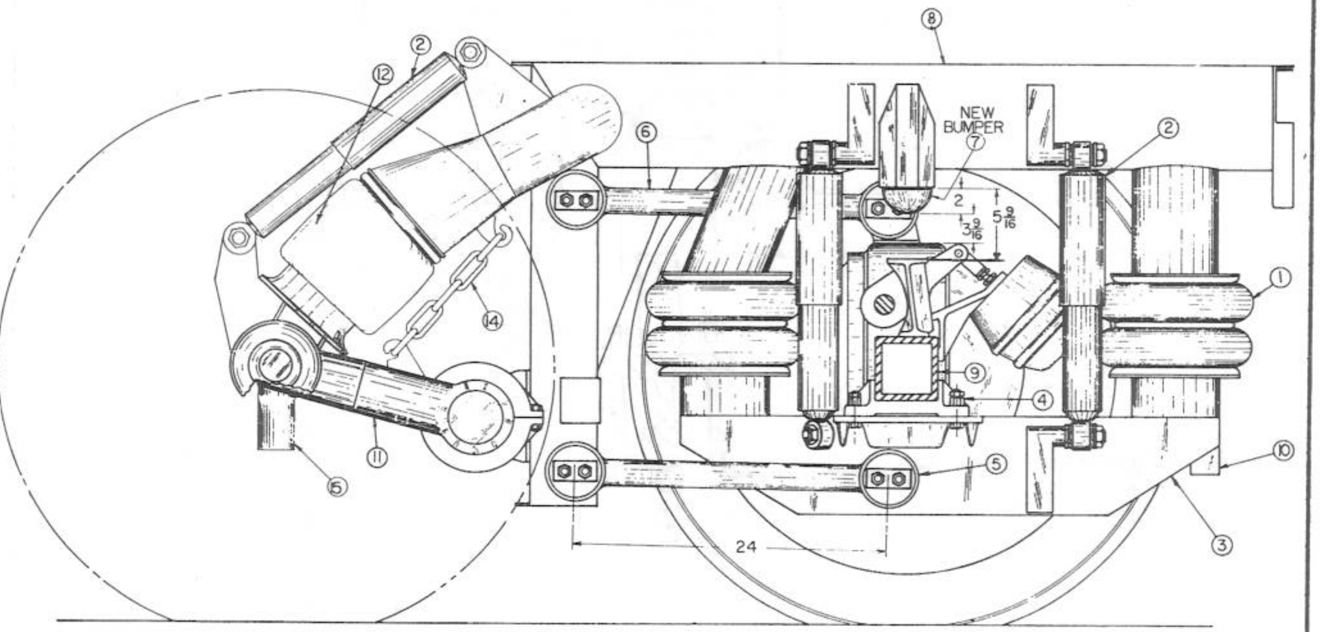


1. Air Bellows
2. Shock Absorber
3. Upper Radius Rod
4. Lower Radius Rod
5. Axle Bumper
6. U - Bolt
7. Suspension Support
8. Air Beam
9. Wheel
10. Rubber Bumper
11. Jacking Point

FIGURE 12 - 4: Front Suspension


⑧
⑬
⑫
⑭
⑥
NEW BUMPER
⑦
②
2
3 9/16
5 9/16
①
⑨
④
⑪
⑮
⑤
⑩
24
③

EFFECTIVE UNIT NO. 10001 thru 11179


⑧
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NEW BUMPER
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②
2
3 9/16
5 9/16
①
⑭
⑨
④
⑪
⑮
⑤
⑩
24
③

EFFECTIVE UNIT NO. 11180-

1. Air Bellows
2. Shock Absorbers
3. Suspension Supports
4. Bolts
5. Lower Radius Rods
6. Upper Radius Rods
7. Axle Bumpers
8. Air Beams
9. Axles
10. Jacking Points
11. Axle Arms
12. Air Bellows
13. Shock Absorbers
14. Hold-Up Chains
15. Jacking Points

FIGURE 12 - 5: Rear Suspension

bead ring nuts in sequence to avoid distortion of the bead ring.

RADIUS RODS

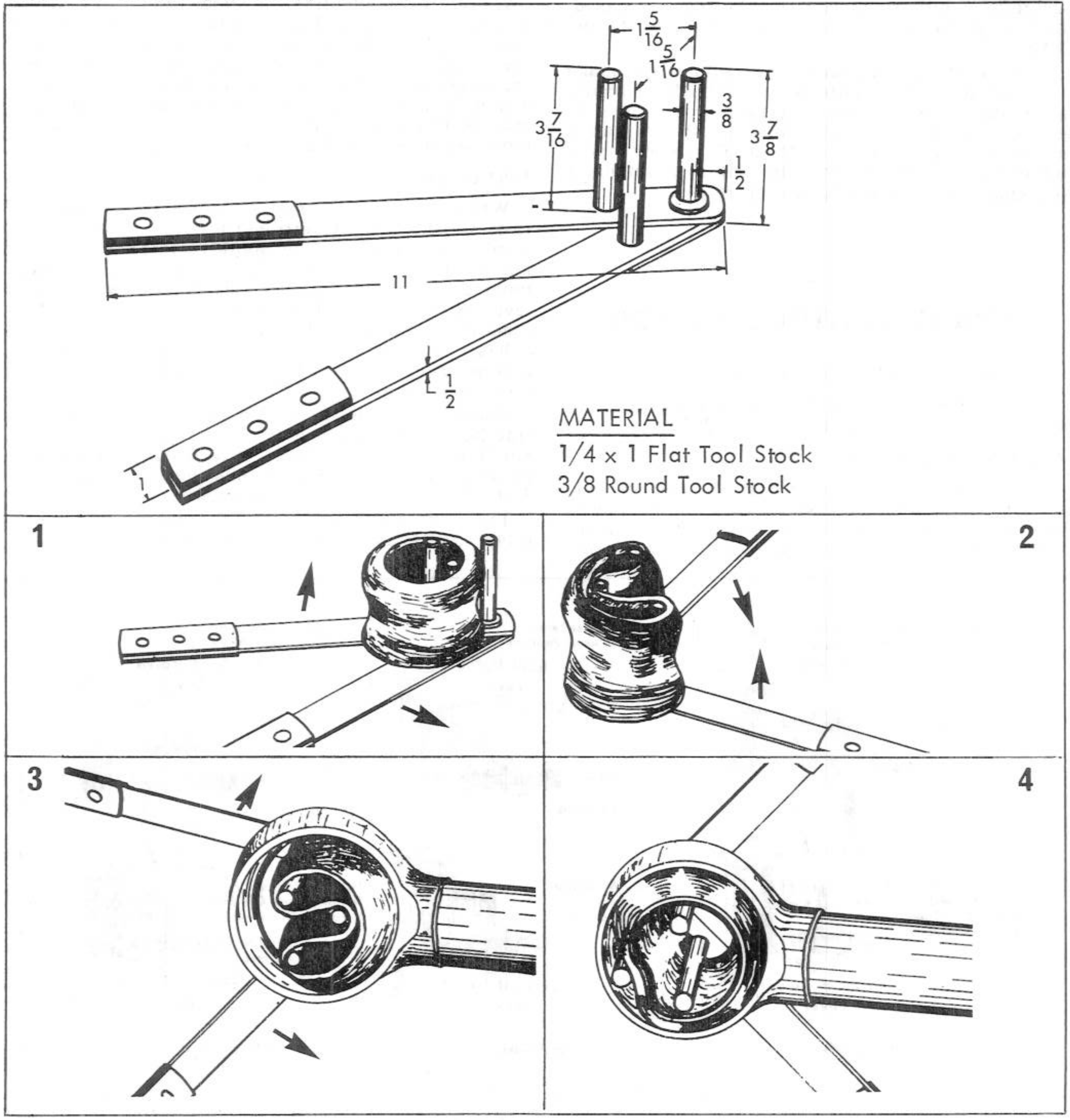
The following instructions apply to radius rods used at the front and rear driving axles.

Radius rods are mounted at both ends by means of rubber bushings. The condition of these bushings should be checked periodically and any defective parts replaced. Radius rods should be checked for distortion and cracks. The "Magnaflux" process is recommended for detecting cracks in the radius rods. New rubber bushings should be used when rods are replaced.

CAUTION **No lubricant whatsoever is to be used at the rubber bushings.**

REMOVAL AND REPLACEMENT

To remove radius rods, flatten attaching nut



MATERIAL
1/4 x 1 Flat Tool Stock
3/8 Round Tool Stock

FIGURE 12 - 6: Radius Rod Bushing Installer

locking plate and remove nuts. Remove radius rod ends from anchor pins, and withdraw radius rod.

For reassembly, it is recommended that the radius rod bushing installing tool shown in Figure 12-6 be used. A suitable tool can be made locally according to the dimensions shown.

Installation of the radius rods is the reverse of removal. It is extremely important upon reconnection of the rods that the proper clearance height between the axle and body is maintained, otherwise the rubber bushings in radius rod ends will become preloaded, shortening the life of these parts. Refer to Figure 12-4 & 12-5.

CAUTION When reinstalling radius rods, make sure that the rod is centered on the bushing before tightening retaining nuts. The radius rod should be held in a centered position with a pry bar against the coach body or axle while the stud nuts are being tightened. After installation, the radius rod retaining nuts should be tightened to 150-165 ft. lbs.

HEIGHT CONTROL VALVES

DESCRIPTION AND OPERATION

The operation of the height control valves and the general design is shown in Figure 12-7.

LOADING POSITION

When loaded, body of vehicle settles. Since valve is linked to suspension, and valve is mounted to vehicle body, valve moves downward with body during loading. As overtravel lever and control shaft turns, intake valve lever presses against pin of valve core. As pin is depressed, air pressure flows through height control valve into air bellows. Increased air pressure expands air bellows and raises body of vehicle. Intake valve is protected by check valve which permits air to travel in one direction only.

NEUTRAL POSITION

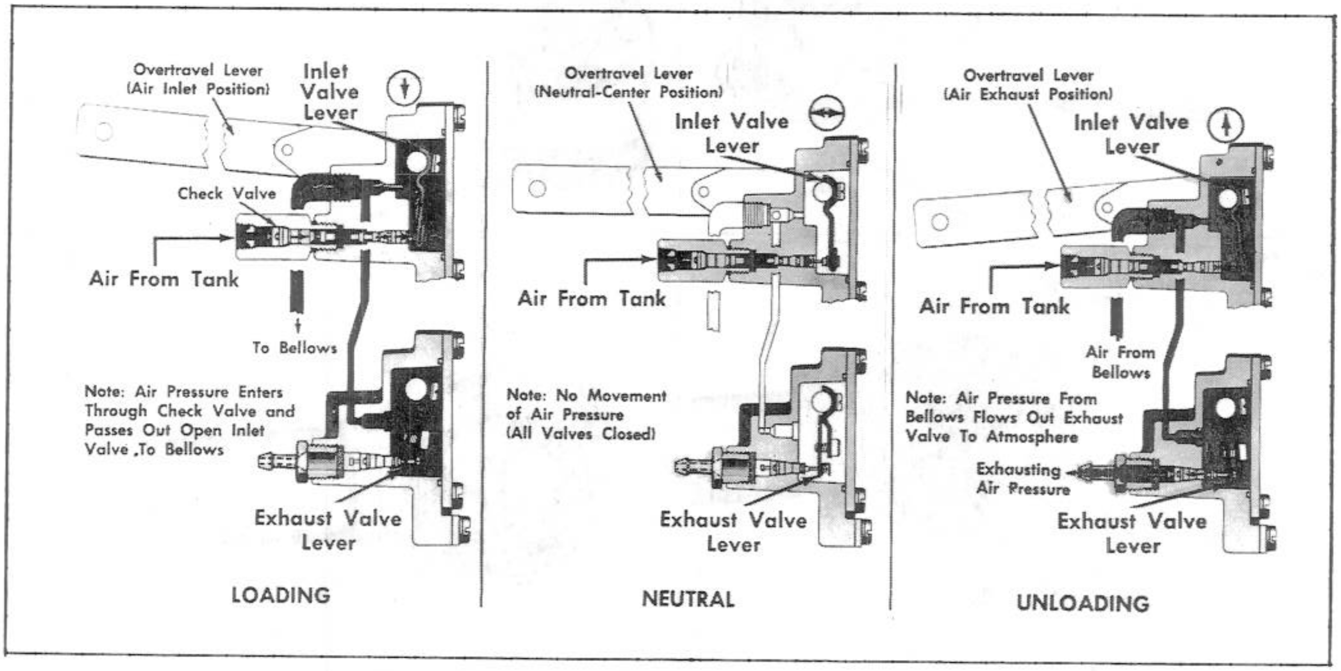
Increased pressure expands air bellows lifting vehicle body and height control valve. The overtravel lever returns to "neutral" as vehicle body approaches normal ride height. Intake valve lever also moves closing valve. The exhaust valve remains closed and the check valve in intake adapter prevents air from escaping from valve body and air bellows. This condition remains static until vehicle load is altered, moving overtravel lever from "neutral" for one or more seconds actuating intake or exhaust valves.

UNLOADING POSITION

When load is lightened, pressure in air bellows raise vehicle body. Overtravel lever is pulled downward from "neutral". This applies a force that slowly moves the delay piston. The exhaust valve lever moving with delay piston, opens exhaust valve when lever moves beyond free travel range. Intake valve remains closed thus allowing air from air bellows to exhaust to atmosphere. As air is exhausted from air bellows, the vehicle body is lowered until overtravel lever returns to "neutral" position.

When vehicle is in motion with body at normal ride height, overtravel lever is in "neutral" position. Small movements of lever may occur without activating control valve as it must move in excess of 3/16" before either valve is opened.

The delay piston, connecting through a pin to overtravel shaft is contained in a cylinder of silicone-type


Overtravel Lever (Air Inlet Position)
Inlet Valve Lever
Check Valve
Air From Tank
To Bellows
Note: Air Pressure Enters Through Check Valve and Passes Out Open Inlet Valve .To Bellows
Exhaust Valve Lever
Overtravel Lever (Neutral-Center Position)
Inlet Valve Lever
Air From Tank
Note: No Movement of Air Pressure (All Valves Closed)
Exhaust Valve Lever
Overtravel Lever (Air Exhaust Position)
Inlet Valve Lever
Air From Tank
Air From Bellows
Note: Air Pressure From Bellows Flows Out Exhaust Valve To Atmosphere
Exhausting Air Pressure
Exhaust Valve Lever

LOADING NEUTRAL UNLOADING

Figure 12-7: Height Control Valve Operation

fluid. The slowing action of this fluid delays from 1 to 6 seconds the closing of one valve to the opening of the other. The flapper valves allow both valves to close from full-open position within 1 second.

The overtravel piston is held against shaft by two springs (one inside the other) and keeps shaft in proper position relative to overtravel lever. Purpose of the piston is to prevent damage of parts inside control valve if lever exceeds normal travel and to allow the lever to move without moving parts inside the valve.

MAINTENANCE

The height control valve requires no periodic maintenance. Height control valve linkage operates on rubber bushings and no lubrication at this point should be attempted.

REMOVAL

1. Support body of vehicle by placing blocks under body by jack points.
2. Open drain cock in air filter and exhaust all air from system.
3. Disconnect overtravel lever from link and pull down to exhaust remaining air from air beams.
4. Disconnect both lines from control valve and cover ends with tape.
5. Detach height control valve from mounting bracket. Replacement is the reverse of removal. After assembly, check for leakage using soap and water.

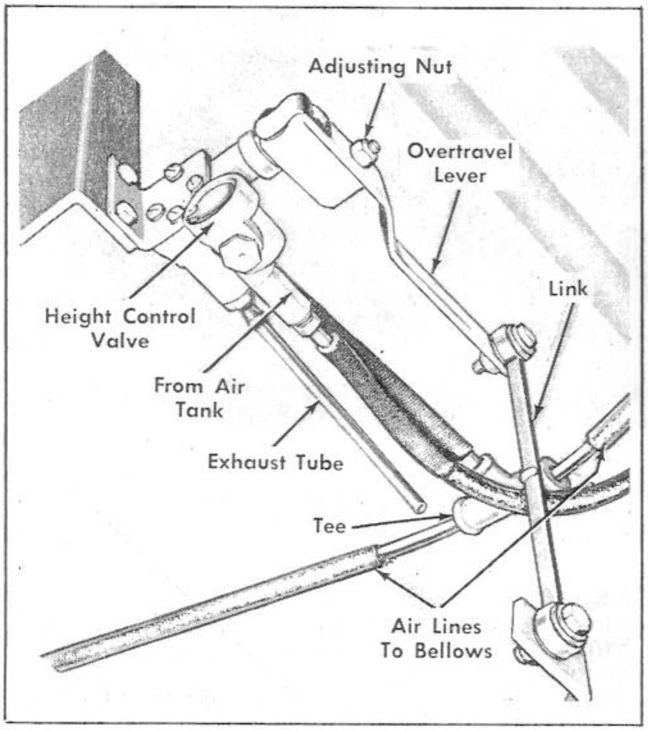


Figure 12-8: Overtravel Lever Adjustment (Front Height Control Valve)

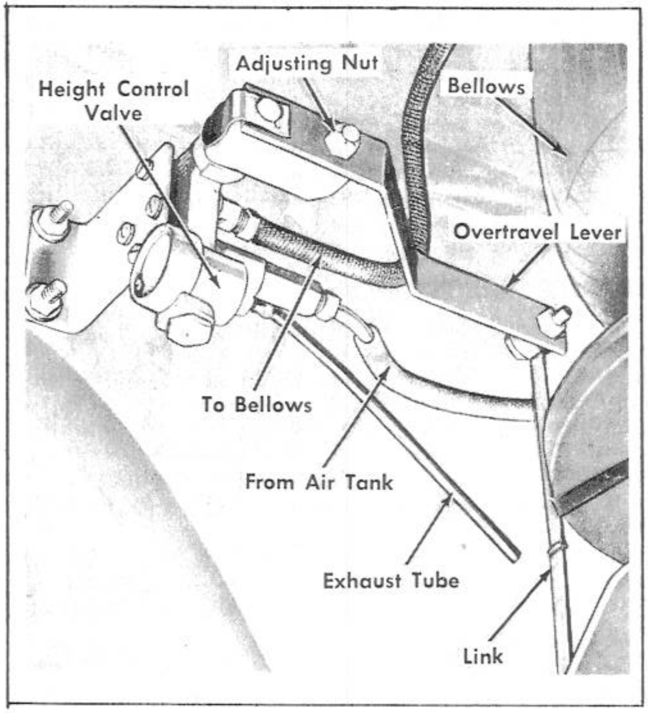


Figure 12-8A: Overtravel Lever Adjustment (Rear Height Control Valve)

HEIGHT CONTROL VALVE AIR LEAKAGE CHECK

The following procedure is for making air leakage check when valve assembly is removed from vehicle.

1. Clean the exterior of the valve assembly.
2. Connect air pressure line to air inlet port, then open the air pressure (70-100 P.S.I.)
3. Dip the valve assembly in a container of water, and watch for air bubbles when the overtravel lever is in the center position. Refer to Figure 12-7. No air should escape from any point of the valve assembly.
4. If bubbles appear from the bellows port, this is an indication that the air inlet valve assembly is defective and must be replaced.
5. Remove air pressure line from air inlet fitting and connect it to the bellows port. If bubbles appear at the air inlet check valve port, this is an indication that check valve unit is defective and must be replaced.
6. If bubbles appear at the exhaust port, it is an indication that the exhaust valve assembly is defective and must be replaced.

6. If bubbles appear at the exhaust port, it is an indication that the exhaust valve assembly is defective and must be replaced.

7. If bubbles appear around edge of valve cover plate, the cover plate gasket should be replaced.
8. If no leaks are found, remove valve assembly from the water, then with air pressure still connected to the bellows port, actuate overtravel lever to remove any excessive amount of water which may have entered exhaust valve chamber. Remove air line and connect it to the air inlet port and repeat operation here to remove water from the air inlet valve chamber.

HEIGHT ADJUSTMENT

The correct coach body height which should be maintained is shown in Figures 12-4 and 12-5. It should not be necessary to make an adjustment at this point under normal service conditions. However, if an adjustment is necessary it is made by changing the position of the overtravel lever in relation to the overtravel control body. The lever should be moved up to raise the level of the coach body, and down to lower it.

To make this adjustment, shut off air supply to trailing wheel bellows, check that air pressure is above 100 P.S.I. and raise the coach to the specified height.

CAUTION: Always adjust on "fill cycle". If it is necessary to lower coach height, release sufficient air to be well below height and adjust to height on fill cycle.

Refer to Figures 12-4 and 12-5. **Note:** Ride height should be checked after road testing.

When it is found that the coach is falling below the correct level after being parked for a period of time, the following procedure should be carried out. Locate the suspension system height control valve which is applicable to the side of the coach which is low. One height control valve controls both front air beams, the rear air beams are controlled by height control valves, one left hand side and one right hand side. Disconnect the air line (inlet from air tank). Remove the adapter assembly (1) and discard. Refer to Figure 12-8B. Remove the two small filter screens located behind the adapter assembly for cleaning (2). Refer to Figure 12-8B. Clean with solvent and air blast. Replace the two small screens and install a new adapter (1) and reconnect air line. Check height control valve for air leaks.

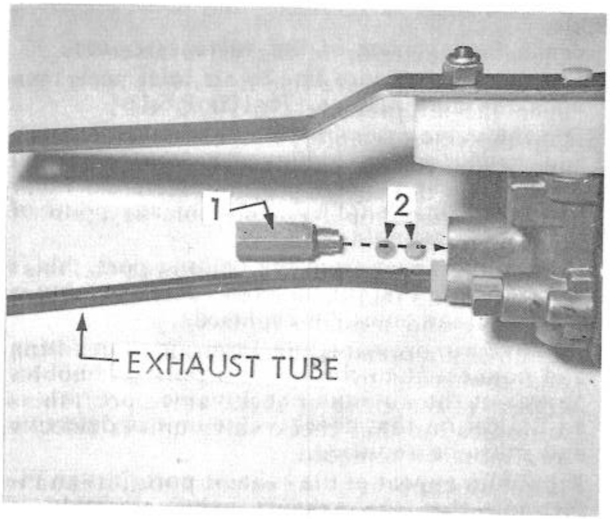


Figure 12-8B: Replacing Height Control Valve Screens and Adapter

OVERTRAVEL LEVER CENTER - POSITION ADJUSTMENT

1. Clean the exterior of the height control valve.
2. Remove delay piston snap ring retainer, cover, and o-ring from control valve assembly, then drain off the silicone fluid.
3. Remove exhaust fitting and exhaust screen from valve.
4. Referring to Figure 12-9, scribe a line 1-3/8" from plug end of overtravel lever control body.
5. Place valve assembly in vise as shown in Figure 12-9.

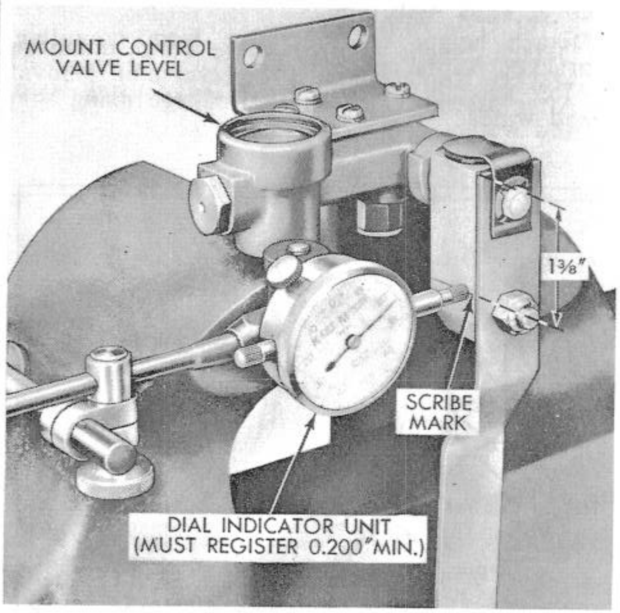

MOUNT CONTROL VALVE LEVEL
1⅜"
SCRIBE MARK
DIAL INDICATOR UNIT (MUST REGISTER 0.200" MIN.)

Figure 12-9: Use of Dial Indicator

6. If vacuum source is available, attach supply hose to valve exhaust port using Sun Tester fitting No. 115-3 or equivalent. Do not apply vacuum at this time.
7. Attach air pressure supply hose to air inlet port. Do not apply pressure at this time.
8. Locate dial indicator in position as shown in Figure 12-9. Move overtravel lever to full air exhaust position — TOP OF DELAY PISTON

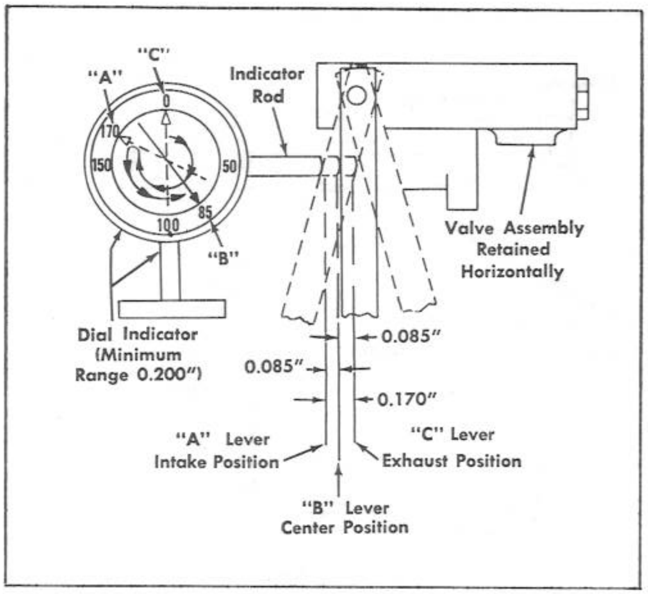

"C"
"A"
Indicator Rod
0
170
150
50
100
85
"B"
Valve Assembly Retained Horizontally
Dial Indicator (Minimum Range 0.200")
0.085"
0.085"
0.170"
"A" Lever Intake Position
"C" Lever Exhaust Position
"B" Lever Center Position

Figure 12-10: Locating Lever Center

FLUSH WITH TOP OF BORE — without overtravel (position "C" Figure 12-10). Relocate indicator push rod to just contact 1-3/8" mark on control body and reset indicator dial to zero at this point (position "C" Figure 12-10).

9. Move overtravel lever to full air intake position without overtraveling (position "A" Figure 12-10) (delay piston at bottom of bore). Take indicator reading which may vary from 0.60" to 0.190".
10. Repeat steps 8 and 9 above to recheck this reading.
11. Divide the total travel dimension by two (Example: 0.170" 2 equals 0.085"), then move overtravel lever back this amount (0.085") to the center (position "B" Figure 12-10).

    IMPORTANT: Without disturbing lever center position, reset indicator dial to zero, which actually is 0.100" on indicator of type registering 0.100" for each revolution of indicator needle, then proceed with valve lever gap adjustments following.

AIR INTAKE AND EXHAUST VALVE LEVER ADJUSTING

Before making these adjustments the overtravel lever must be centered as explained previously.

Two methods of adjustment are available.

1. Using both air pressure and vacuum: If vacuum source is available, this method will take less time to perform adjustment. Vacuum source is used to make the exhaust valve lever gap check only .
2. Using air pressure only: When this method is used, it will take longer to perform adjustments as the valve cover must be in place each time air pressure is applied and then removed to permit adjustment of exhaust valve lever.

Instructions covering lever adjustments are identical for front and rear valves. Rear valve lever and front valve lever must be bent to proper setting. In these valves both exhaust and intake levers are part of one unit which contains "score" marks to permit easy bending. Personal may accomplish this operation with lever in the valve body, or lever may be removed and bent on the bench.

VACUUM METHOD

1. Apply available vacuum and regulate air pressure to approximately 95 P.S.I.
2. Move overtravel lever fore and aft several times and then back to center position.
3. Starting at center position, slowly move lever to where air intake valve just begins to open. Listen for escaping air. Note reading on dial at this point. Reading should be 0.025" to 0.027" from lever center position. If necessary, bend intake valve lever to correct setting, refer to Figure 12-11.
4. Return overtravel lever to center position. Slowly move lever to exhaust side and at the

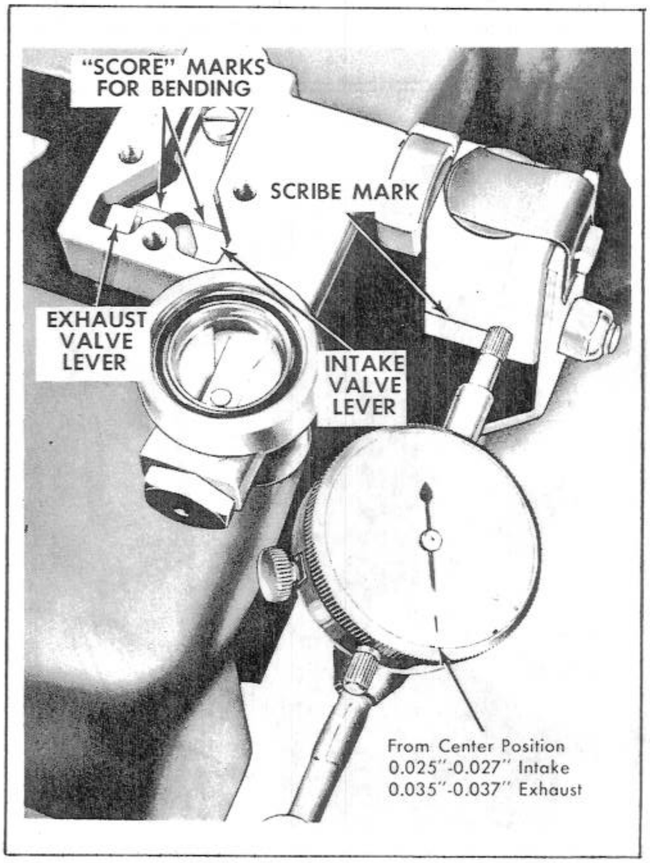

"SCORE" MARKS FOR BENDING
SCRIBE MARK
EXHAUST VALVE LEVER
INTAKE VALVE LEVER
From Center Position
0.025"-0.027" Intake
0.035"-0.037" Exhaust

Figure 12-11: Adjusting Air Lever Gap

same time note the vacuum gauge reading. When vacuum just begins to fall, the exhaust valve has opened. Valve should open when overtravel lever is moved 0.035" to 0.037" from center position. If necessary, bend exhaust valve lever to correct setting, refer to Figure 12-11.

AIR PRESSURE METHOD

This method may be performed when a vacuum source is not available.

1. Apply air pressure regulated to approximately 95 P.S.I. to air inlet port.
2. To adjust air intake valve lever gap, move the overtravel lever slowly from center position to point where intake valve just begins to open. Listen for escaping air. Note reading on dial at this point which should register 0.025" to 0.027". If necessary, bend intake valve lever to correct setting. Refer to Figure 12-11.
3. To adjust air exhaust valve lever gap, install valve cover on the valve using a new gasket and four attaching screws. Be careful not to disturb indicator setting, disconnect air supply from the air inlet port and connect it to the bellows port. Move overtravel lever slowly to open exhaust port while observing the indicator dial. Air should start to escape from exhaust port when indicator registers 0.035" to 0.037". If adjustment is necessary, shut off air pressure supply and remove valve cover. Bend exhaust valve lever to correct setting; then install cover and recheck valve opening dimension.

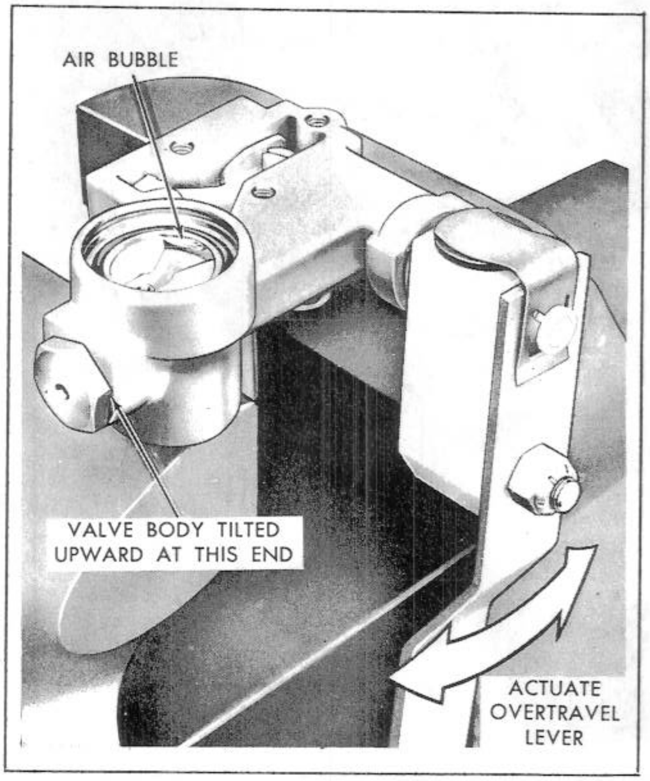


Figure 12-12: Venting Air From Silicone Fluid

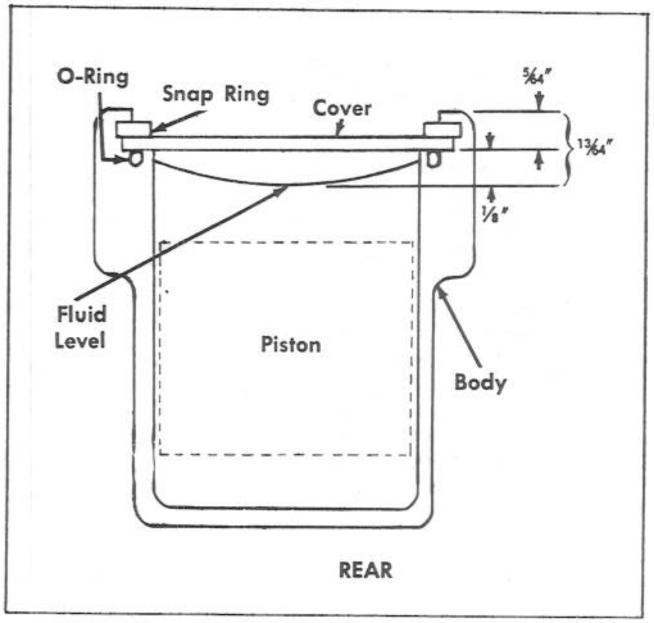


Figure 12-13: Measuring Silicone Fluid Level

TIME — DELAY CHECK — PRELIMINARY PROCEDURES

After adjusting valve gaps check time-delay for opening and closing of valves (1-6 seconds) one valve to opening of the other is recommended. Valves should close from full-open position within one second.

1. Place new O-ring over delay plug and install plug. Tighten to 20-30 inch-pounds torque.
2. Pour 5.5 CC ± 0.25 CC of Silicone fluid (750 Centislokes Viscosity at 25°C) into delay piston chamber. With valve body tilted slightly as shown in Fig. 12-12 carefully operate overtravel lever fore and aft to vent air from fluid. When all air has been expelled from piston pin cavity, check fluid level using depth gauge as shown in Figure 12-13.

With valve assembly level, take measurement from center of bore only. Add or remove fluid to bring fluid 13/64" from top of valve body. An eyedropper will serve for this purpose.

3. Place new delay piston cover O-ring in groove

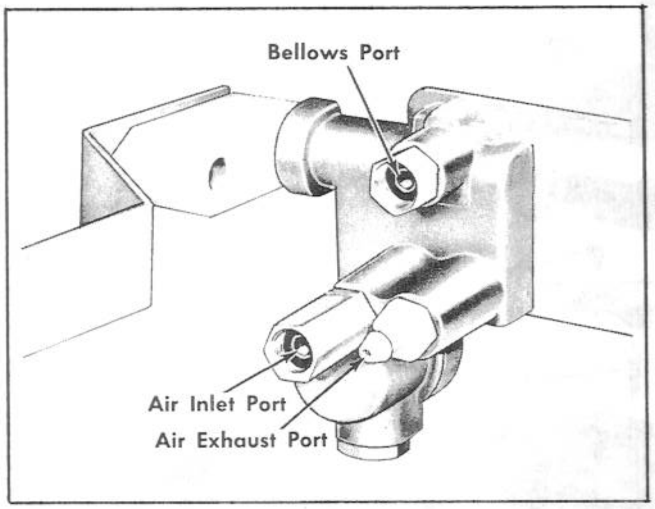


Figure 12-13A: Height Control Valve Air Ports

of valve body. Install cover with snap ring retainer.

4. Place valve assembly vertically in holding vise, Refer to Figure 12-14.
5. Move overtravel lever up and down for approximately one minute.

AIR INTAKE TIME-DELAY CHECK

1. Correct pressure line to intake valve port and open air pressure at 95 P.S.I.
2. Move the overtravel lever upward quickly approximately two inches and simultaneously start counting the number of seconds before air starts to escape from bellows ports. A delay of 1-6 seconds should exist. Repeat this check.

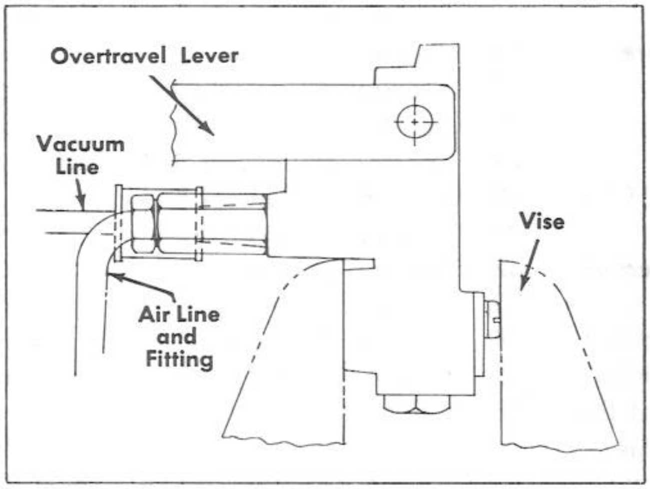


Figure 12-14: Valve Position For Time - Delay Check

AIR EXHAUST TIME DELAY CHECK

To time the delay for exhaust, two methods can be used; one using vacuum source and one using air pressure.

1. METHOD USING VACUUM: Install cover plate at height control valve using gasket. Connect pressure line to air exhaust port and open air pressure to 95 P.S.I. Move the overtravel lever downward quickly approximately two inches and simultaneously start counting the number of seconds before the vacuum gauge starts to drop off. A delay of 1 to 6 seconds should exist. Repeat this check.
2. METHOD USING AIR PRESSURE: Install valve cover with new gasket on valve assembly. Connect air pressure supply hose to bellows port. Move overtravel lever downward two inches and simultaneously start counting the seconds before air starts to escape from the exhaust port. A delay of 1 to 6 seconds should exist.

A time delay over 6 seconds could mean too large a valve lever gap adjustment and a time delay under 1 second would mean too small a valve lever gap adjustment. If the time delay is not within 1 to 6 seconds, first recheck the fluid level. If fluid level is satisfactory, the valve lever gap adjustment must be repeated.

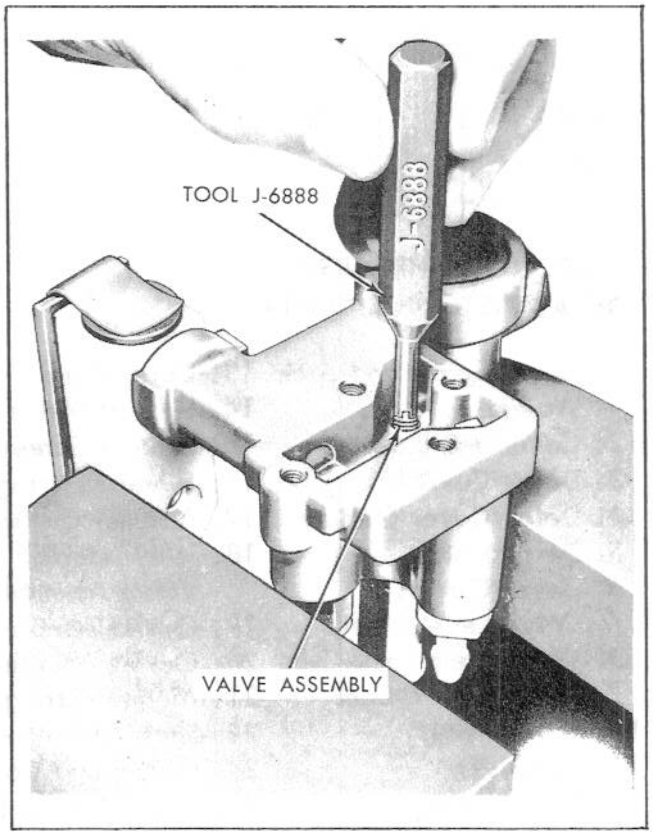
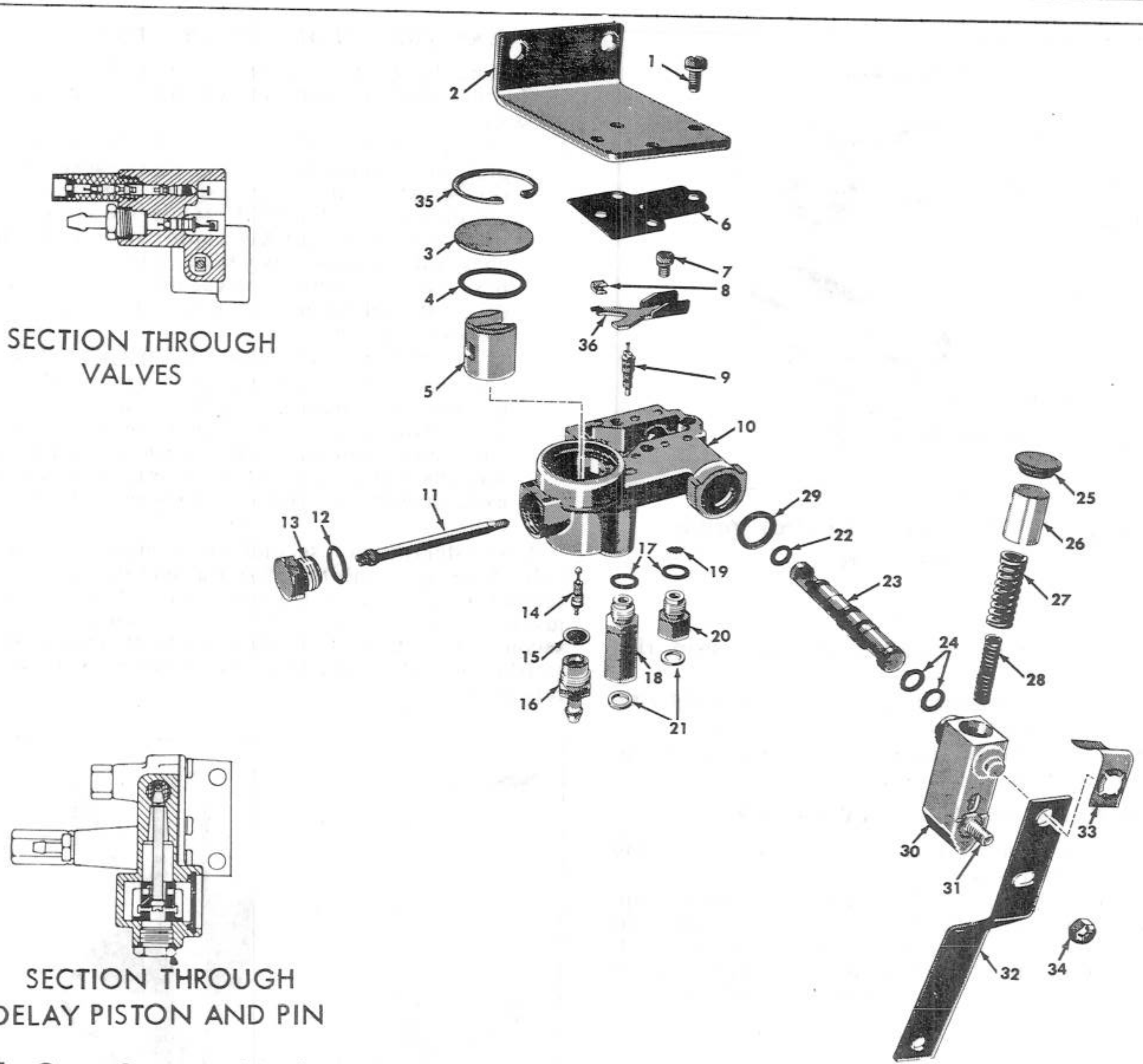


Figure 12-16: Replacing Valve Core Assemblies


SECTION THROUGH VALVES

SECTION THROUGH DELAY PISTON AND PIN

1. Cover Screw and Lock Washer
2. Cover and Bracket
3. Delay Cover
4. Delay Cover O-Ring
5. Delay Piston
6. Cover Gasket
7. Valve Lever Screw
8. Valve Stem Lock Clip
9. Intake Valve Core
10. Valve Body
11. Piston Pin
12. Plug O-Ring
13. Delay Plug
14. Exhaust Valve Core
15. Exhaust Screen
16. Exhaust Fitting
17. Adapter O-Ring
18. Inlet Adapter and Check Valve Assembly
19. Outlet Adapter Screen
20. Outlet Adapter
21. Airline Fitting Gasket
22. Shaft O-Ring (Medium)
23. Overtravel Control Shaft
24. Shaft O-Ring (Large)
25. Overtravel Body Plug
26. Overtravel Piston
27. Overtravel Spring (Large)
28. Overtravel Spring (Small)
29. Overtravel Control Body Seal
30. Overtravel Control Body
31. Overtravel Lever Stud
32. Overtravel Lever
33. Plug Retainer
34. Lever Stud Nut
35. Delay Cover Retainer
36. Intake and Exhaust Valve Lever

Figure 12-15: Height Control Valve Disassembled

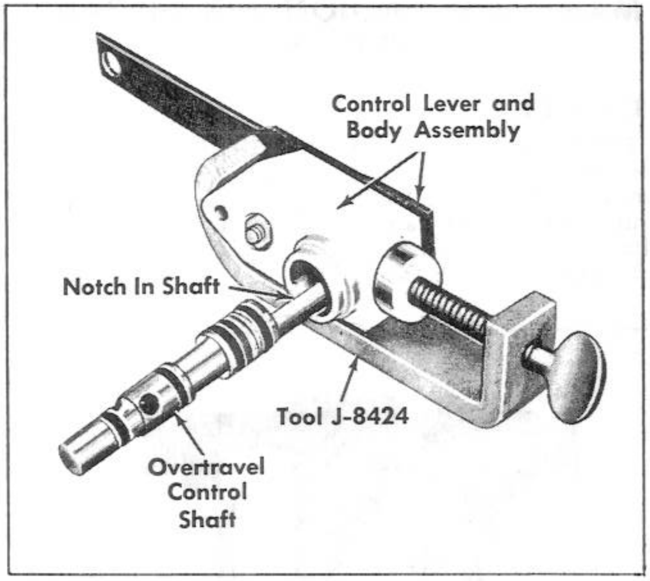


Figure 12-17: Replacing Overtravel Lever

After obtaining proper valve adjustments, install valve cover using new gasket. Install new screen in bellows port. If screen was removed from exhaust port, install new screen and exhaust fitting.

Place tape over ends of air line ports until such time as valve assembly is installed on the vehicle.

DISASSEMBLY

Refer to Figure 12-15 for identity of parts.

1. Remove inlet adapter and check valve assembly (18) from valve body (10). Remove outlet adapter (20). Remove adapter O-rings (17). Remove air line fitting gasket (21) from adapters. Remove outlet adapter screen (19).
2. Remove four cover screws and lockwashers (1) from cover and bracket (2). Remove cover, bracket and gasket (6).
3. Position valve with delay plug (13) at top. Unscrew delay plug from valve body (10). Drain silicone fluid from cavity. Remove plug O-ring (12). Unscrew piston pin (11) from control shaft (23).
4. Remove delay cover retainer (35), cover (3) and cover O-ring (4). Remove delay piston (5). Discard O-ring.
5. Remove valve lever screw and lockwasher (7) from valve lever. Remove exhaust valve and intake valve lever (36) from valve body.
6. Remove valve stem lock clip (8) from stem of exhaust valve core. Spread locking arms and slide clip from around stem.
7. Pull overtravel assembly and shaft from valve body.
8. Remove intake valve core (9) with tool (M.C.I. Part No. 20-35), Refer to Figure 12-16.
9. Remove exhaust fitting (16) and screen (15), then remove exhaust valve core (14) with tool (M.C.I. Part No. 20-35), Refer to Figure 12-16.
10. Remove plug retainer (33) from overtravel control body (30). Retainer must be cut off. Use caution to avoid damage to nylon body. Remove overtravel body plug (25).
11. Place forked end of tool (M.C.I. Part No. 20-36) around shaft in overtravel control body (30), then tighten clamp screw, Refer to Figure 12-17.

    CAUTION: Tighten tool until overtravel control shaft (23) can be turned 90° to allow notch in shaft to pass free of overtravel piston (26). Do not apply more pressure than is required.

Remove overtravel control shaft (23) and overtravel control body seal (29) from body. Remove shaft O-rings (22 & 24). Back off vise jaw and take body and tool from vise. Remove tool, overtravel piston (26), overtravel lever large spring (27), and overtravel lever small spring (28) from body. Remove lever screw nut (34) from overtravel lever screw or stud. Remove lever (23) from body.

CLEANING AND INSPECTION

1. The following parts should be discarded and replaced with new parts at each overhaul: Plug retainer (33), overtravel control body seal (29), gasket (6), and O-rings (22, 24, 17, 12 and 4).
2. Thoroughly clean all metallic parts in a suitable cleaning solvent. Blow parts dry with compressed air.
3. Inspect all bearings and rubbing surfaces for scoring, factures or noticeable wear. Discard all damaged or worn parts and replace with new parts.

REASSEMBLY

CAUTION: Height control valve parts must be kept free from dirt and moisture.

1. Install intake valve core (9) and exhaust valve core (14) with screen (15) in control body (10) as shown in Figure 12-16. Tighten to 2-1/2 to 3 inch-pounds torque. Install exhaust fitting (16).
2. Lubricate overtravel control body with multipurpose grease. Assembly overtravel components as follows:

(A) Install overtravel lever (32) on control body. Place lever stud nut (34) on stud and torque to 70-80 inch pounds.

(B) Place overtravel lever large spring (27), and overtravel lever small spring (28) inside piston (26). Insert piston in control body (30).

(C) Place three new O-rings (22 and 24) on overtravel control shaft (23). Lubricate shaft and O-rings with multi-purpose grease.

(D) Position fork of tool (M.C.I. Part No. 20-36) so that the shaft can be inserted in body. Carefully apply pressure with clamp screw (Refer to Figure 12-17). Compress springs only enough to allow shaft to be inserted. Install overtravel control shaft (23). Rotate shaft so that flat is next to piston, and remove tool (M.C.I. Part No. 20-36).

(E) Insert overtravel body plug (25) in bore of body. Force new plug retainer (33) in position over nylon pivot and body plug (25).

(F) Place new overtravel control body seal (29) on shoulder of body. Slide overtravel assembly into valve body (10). Insert carefully to avoid seal damage.

(G) Place delay piston (5) in valve body with open side of piston toward the overtravel shaft (23).

(H) Align pin openings in piston and in shaft. Fit piston pin (11) in toppered side of hole in shaft. Tighten pin to 70-80 inch pounds torque.

(I) Place intake valve and exhaust valve lever (36) in position on overtravel shaft. Make sure the fork on the exhaust lever side is around stem of exhaust valve core (14). Fork should be high enough on stem so that stem will not be held open. Insert valve lever screw (7) and tighten to 8-10 inch pounds torque.

(J) Spread ends of valve stem lock clip (8) slightly and place on exhaust valve stem around stem head. Use suitable tool to brace stem and pinch ends of clip just enough to secure on stem. Clip must rotate freely on stem.

(K) Using new O-ring (17), install air inlet adapter and check valve assembly (18) into valve body.

(L) Make all of the valve assembly adjustments explained under "Height Control Valve Adjustments" earlier in this section.

SHOCK ABSORBERS

DESCRIPTION

Shock absorbers are double-acting airplane type. They are a welded construction and cannot be repaired.

Front, rear and rear trailing shock absorbers are identical and may be interchanged.

OPERATION

The operation of the shock absorber is quite simple. Fluid contained within the shock absorber is forced through a restricted opening by a piston when the suspension air bellows are flexed. The main function of the shock absorber is to regulate the vehicle axle travel by dampening the rebound motion.

REMOVAL AND REPLACEMENT

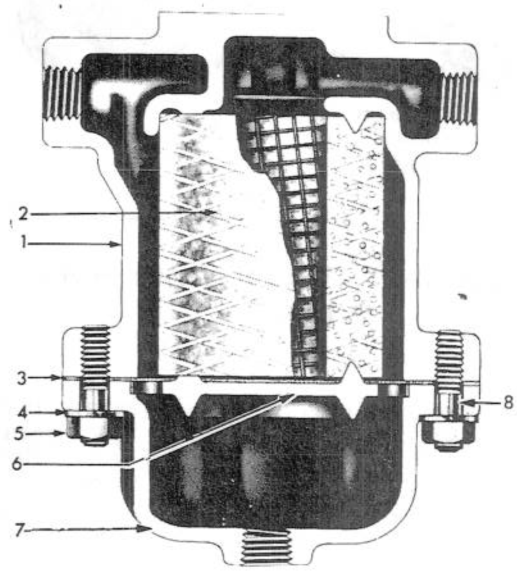
Remove nuts and washers from shock absorbers upper and lower mounting pins. Withdraw shock absorbers assembly from pins.

Replacement is the reversal of removal. New rubber mounting bushings should be used when shock absorbers are replaced. Tighten shock absorbers mounting pin stud nuts to 150-160 foot-pounds torque.

MAIN SUSPENSION AIR FILTER (TYPE "E")

DESCRIPTION

The purpose of the Type "E" air filter is to keep the suspension and accessory air system free from foreign matter. The filter is located on a mounting strap on the right hand front air tank with the air filter itself facing to the inside between the right and left hand front air tanks.



1. Body
2. Element
3. Gasket
4. Lockwasher
5. Nut
6. Support
7. Cover
8. Stud

Figure 12-18: Type "E" Filter

The filter element and cover gasket should be replaced approximately every 50,000 miles under average operating conditions. It may be necessary to change the element and gasket more or less frequently depending on the amount of dirt and sludge etc. accumulated in the filter. It is also recommended that the change be made prior to seasonal freezing temperatures to prevent element from freezing due to possible water sludge in the system.

AIR FILTERS

DESCRIPTION

The maintenance of the filtration in the air suspension system is of prime importance. Two air filters are located between the rear suspension height control valves and the left hand and right hand air beams. Effective Unit No. 10001 thru to Unit No. 12403, two air filters are located between the front suspension height control valve and the front air beams left and right hand. Effective Unit No. 12403, the two front air filters are replaced by one filter installed ahead of the tee fitting located between the left and right hand air beams. These air filters prevent the entrance of foreign matter from the air beams and suspension members, into the height control valve when the air pressure is exhausted from the system. The air filter and check valve assembly is used at the inlet port of each height control valve. These filters exclude foreign matter and the check valve assembly is used at the inlet port of each height control valve. These filters exclude foreign matter and the check valve prevents air beam pressure from returning to the auxiliary air system. Regular service intervals should be maintained on these assemblies. If the filter elements become clogged they will retard the air flow in and out of the system.

REMOVAL

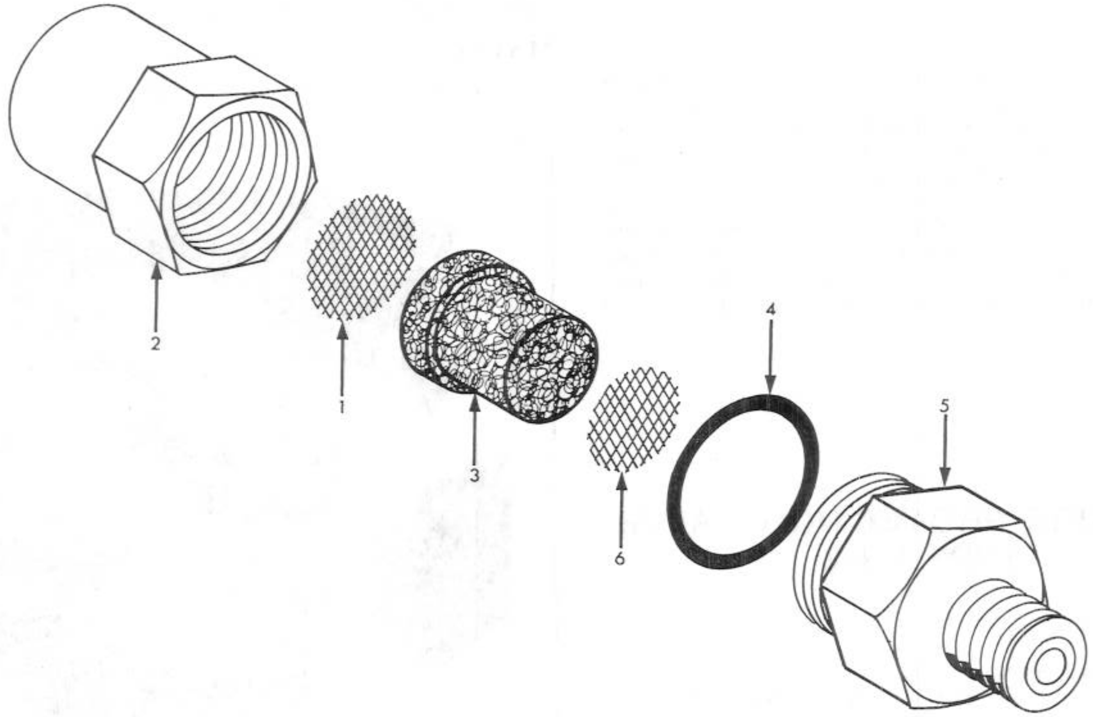
The vehicle should be blocked up with the weight of the coach on blocks and air pressure exhausted from auxiliary system by opening drain cock on auxiliary air tank. Remove height control valve link. Do not disturb link adjustment. Move control arm down to exhaust air from bellows and air beam. Disconnect air lines from air filters. Disconnect air lines from filter and check valve assemblies at control valve body and remove from control valve. Cover inlet port of control valve to prevent entry of dust and dirt.

DISASSEMBLY

Clamp filter in vise and remove filter element and grommet from body. On the air filter and check valve clamp same in vise with filter cover up. Remove cover from body and remove filter element. Use end wrench on check valve cap and remove cap from body. Lift check valve spring out of body and remove body from vise. Check valve is then loose.

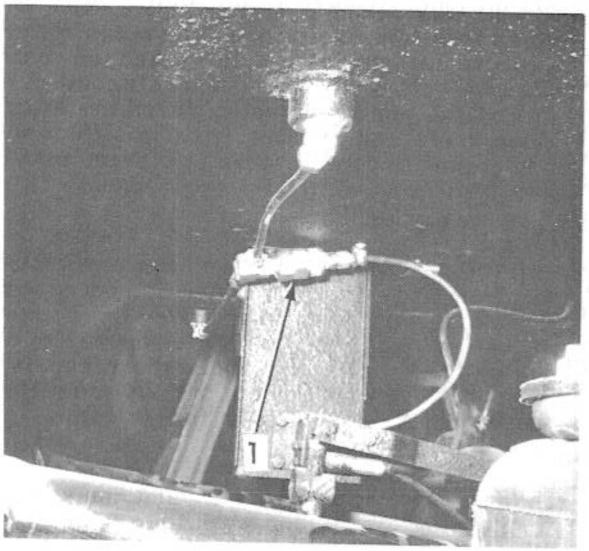
REPAIR

Examine bronze filter elements and immerse all parts in cleaning solvent and wash thoroughly. Blow out all parts with compressed air and blow air through bronze filters. Examine check valve seat. Seat must be clean and free from scratches or damage. If seat is damaged, replace body. Always use new grommets on reassembly.



1. Screen	3. Filter	5. Body
2. Cover	4. Grommet	6. Screen

Figure 12-19: Air Line Filter



1. Air Line Filter

Figure 12-20: Air Line Filter Installed between L.H. & R.H. Front Air Beams

REASSEMBLY

On air filter hold body in vise, large end up. Apply lubricant to new grommet and at bottom of threads on filter body. Place on filter element with the small end up and place spring over filter. Tighten filter cover on to the body firmly. On filter and check valve install filter in same manner into filter and check valve body. Check valve may then be dropped into body with flat side down against seat. Place spring over raised center. Install grommet on check valve cap and tighten cap firmly into the check valve end of the body.

PRESSURE PROTECTION VALVE TYPE PR-2

DESCRIPTION

A type PR-2 pressure protection valve is located on the right hand side front of the dry air tank in the rear of the front wheelhousing. The pressure protection valve is mounted to the supply port of the Type "E" main suspension air filter. The pressure protection valve controls the pressure at which compressed air would be delivered to in the system. The valve remains closed until a pre-set supply pressure is reached (which is 65 P.S.I.). It then opens and passes air out the delivery port. The chief uses for this valve is to protect the main air system. To control the amount of air taken from the main air brake system to operate auxiliary devices. By locating the pressure protection valve between the dry air tank and park brake air tank, air is maintained in the main air brake system before being supplied to the park brake air tank for quick build-up systems for emergency applications.

The pressure protection valve has a 1/4" delivery port on the bottom and a 1/4" supply port on the side. Two (2) 9/32" mounting holes are cast into the body for mounting purposes if required.

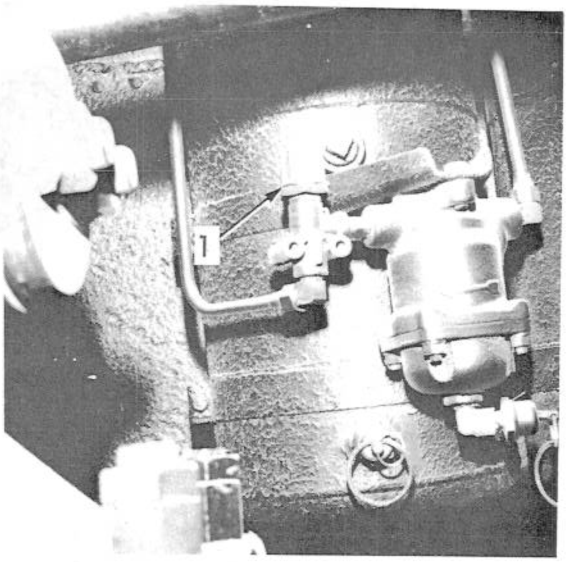
OPERATION

Compressed air enters the supply port, and is stopped by the inlet valve which is on its seat. When the air pressure entering the supply port overcomes the pressure setting of the spring above the piston, the piston moves upward and leaves the inlet valve off its seat, allowing air to pass out the delivery port. When air pressure underneath the piston is reduced to a lesser force than that of the spring above the piston, the spring forces the piston down, closing the inlet valve and stopping further flow of air through the delivery port of the valve.

The pressure setting is determined by the force of the spring which is controlled by the cap on the top of the valve. Turning the cap clockwise raises the pressure setting; turning the cap counterclockwise lowers the pressure setting. The lock nut must be tightened after each adjustment.

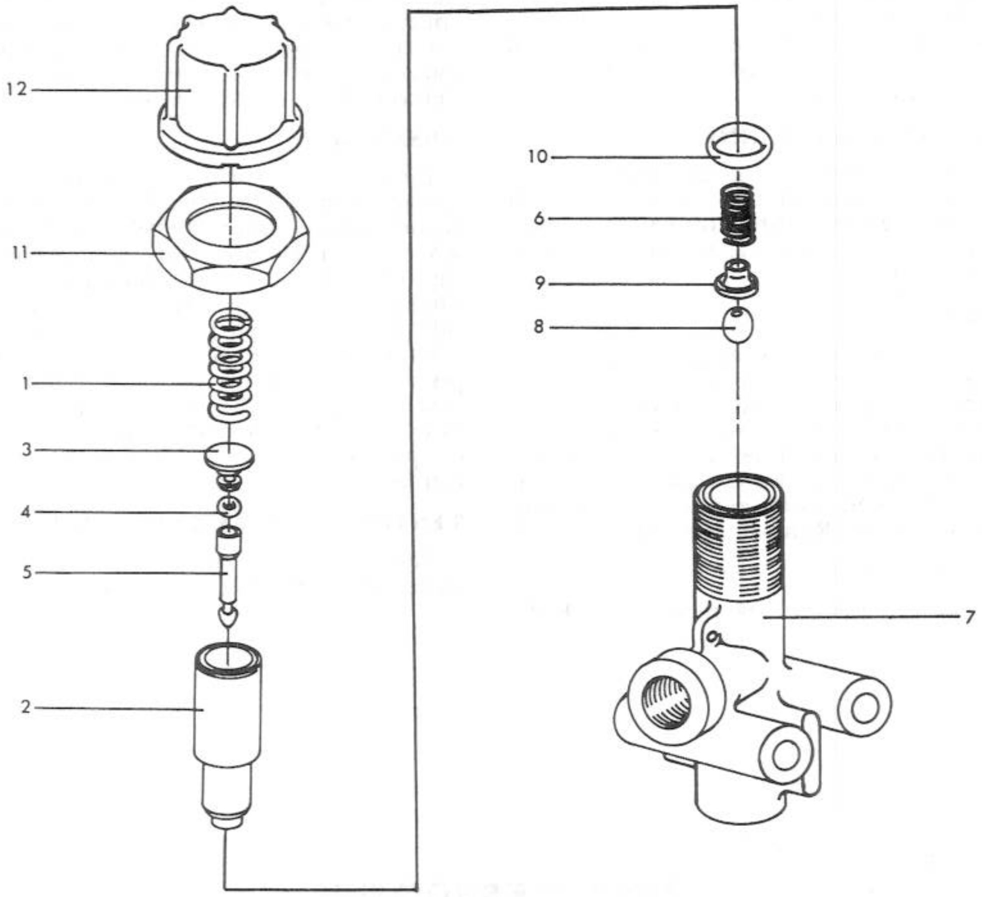
MAINTENANCE

Every 6 months or 30,000 miles, connect a test



1. Pressure Protection Valve

Figure 12-21: Pressure Protection Valve Installed



1. Spring
2. Piston
3. Piston Plug
4. Grommet - $\frac{1}{4}$"
5. Valve Stem
6. Valve Spring
7. Body
8. Valve
9. Valve Guide
10. Grommet - .590"
11. Stamped Nut
12. Adjusting Nut

Figure 12-22: Pressure Protection Valve
Disassembled

gauge to the delivery line and check pressure setting by observing at what pressure valve closes by venting the delivery system. If pressure setting varies more than 5 P.S.I. from the specified setting (which is 65 P.S.I.), adjust. (See Operating and Leakage Checks). Tighten lock nut after each adjustment.

Every year or 100,000 miles, dismantle the valve and clean all parts. Replace rubber parts showing signs of wear. Assemble the valve, check and adjust valve to specified 65 P.S.I.

OPERATING AND LEAKAGE CHECKS

It is recommended to preform an operating and leakage check the following procedure be followed. Remove the pressure protection valve from the vehicle and the following bench test be made.

Mount the valve with a variable air supply and a small delivery volume. Connect an accurate gauge in both the supply and delivery lines. Increase supply pressure until the gauge in the delivery line equals that of the gauge in the supply line. Close supply line and vent delivery line and note supply pressure when the valve closes which is indicated by the drop of pressure at the delivery line gauge. Adjust valve if pressure setting varies more than 5 P.S.I. from the specified setting (which is 65 P.S.I.).

LEAKAGE CHECK: With supply pressure at approximately 100 P.S.I., soap the area around the slot in the adjusting cap. No leakage is permitted. Leakage at this point would indicate a leaking piston O-ring or piston plug O-ring.

Vent the delivery line, and check for leakage. No leakage is permissable. Leakage at this point would indicate a faulty inlet valve.

If the pressure protection valve does not function as described, or leakage is excessive it should be repaired with genuine parts.

REMOVING AND INSTALLING

Block and hold the vehicle by means other than air brakes. Drain dry and wet air tanks. Disconnect all air lines from the pressure protection valve. Loosen valve and remove. Check and clean air lines to valve. Mount valve securely.

DISASSEMBLY

Loosen lock nut and remove adjusting cap (12), then lock nut (11). Remove pressure regulating spring (1). Remove piston (2) and inlet valve assembly from the body. Remove inlet valve (8) from stem (5), spring retainer (9) and inlet valve spring (6). Turn the piston (2) over, depress the inlet valve stem (5) fully. This will loosen piston plug (3) with O-ring (4) from center of piston. Remove piston O-ring (4).

CLEANING AND INSPECTION

Wash metal parts in a good cleaning solvent. Rubber parts such as O-rings should be wiped clean. Inspect all parts for wear or deterioration. Check spring for cracks, corrosion or distortion. Inspect all rubber parts and replace if they show signs of cracks, wear, deterioration or are swollen.

ASSEMBLY

Before assembling the pressure protection valve, lubricate the piston, grommets and body bores with recommended lubricant BW-204-M (M.C.I. Part No. 4A-15-113). Install valve stem (5) in piston (2). Put small O-ring (4) on the piston plug (3). Install piston plug (3) pressing snugly into piston body (2). Install inlet valve spring (6), spring retainer (9) and snap on rubber inlet valve. Slip piston O-ring (10) on end of piston (2) and move to the shoulder of the body (7). Insert the piston (2) into the valve body (7) slowly so as not to cut O-ring (10). Place spring (1) into center of piston. Replace adjusting cap lock nut (11). Replace adjusting cap nut (12).

TESTING FOR SERVICEABILITY

Test and check the pressure protection valve as outlined in "Operating and Leaking Checks".

TROUBLESHOOTING

MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE MEASURE
Bellows deflate overtime.	Defective check valve assembly.	Replace check valve assembly.
	Defective exhaust valve assembly.	Replace exhaust valve assembly.
	Leak in air line and/or bellows.	Replace air line or bellows.
	Defective valve cover rubber O-rings or gasket.	Replace valve cover O-rings or gasket.
Bellows raise to full height and fail to exhaust air pressure.	A clogged exhaust screen in height control valve assembly.	Remove and clean screen.
	A combination clogged exhaust screen and a defective air inlet valve assembly.	Clean exhaust screen and replace air inlet valve assembly.
Intermittent hissing noise at height control valve during operation.	Loss of time delay action fluid in height control valve assembly.	Add fluid, then install new cover and delay piston plug gasket O-rings.

TROUBLESHOOTING (Cont'd)

MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE MEASURE
Erratic valve action.	Dirt or foreign matter in the air valve lever chamber.	Remove valve cover and blow out dirt. Install cover using new gasket.
	Defective valves.	Overhaul height control valve assembly.
Vehicle body fails to out.	Improper height control valve overtravel lever adjustment.	Adjust lever as directed under "Overtravel Lever Adjustment" instructions.

SPECIFICATIONS

SUSPENSION BELLOWS (FRONT & REAR AXLES)	
Make	Firestone
Type	Double-Convolution
No. Convolutions	Two
Diameter, Front	9"
Diameter, Rear	12"

SUSPENSION BELLOWS (REAR TRAILING AXLE)	
Make	Firestone
Type	Rolling-Lobe
Diameter	11"

HEIGHT CONTROL VALVES	
Make	Delco Products
Number, Front	1
Number, Rear	2

SHOCK ABSORBERS	
Make	Delco Products
Type	1-3/4" dia. Cyl. Double Acting
Model No.	F450W
Valve Code	3(1)N10/J3
Collapsed Length	16-5/8"
Extended Length	26-5/8"
Travel	10"
Number Used	2 Front; 4 Rear Drive; 2 Rear Trailing

TORQUE SPECIFICATIONS

Radius Rod Mounting Pin Stud Nuts	150-165 ft. lbs.
Shock Absorber Mounting Pin Stud Nuts	150-165 ft. lbs.
Rear Axle to Suspension Support U-Bolts Nuts	210-240 ft. lbs.
Front Axle Suspension Support Stud Nuts and U-Bolts	150-165 ft. lbs.

(Above figures apply when using No. 110 Lubriplate on threads. If nuts are installed dry, double the figures given).

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

TRANSMISSION

DESCRIPTION

The transmission has four forward and one reverse speeds. The transmission gears used for forward speeds are of helical constant-mesh design, where sliding clutches are shifted on splined shafts to lock respective gears and provide a power train for each speed.

Transmission parts are housed in an aluminum alloy case which has steel inserts where required. Transmission shafts are carried on ball and roller bearings. The clutch housing is directly mounted on the transmission.

Transmission speeds are selected manually by means of a conventional shift lever at the driver's position. Two rods are connected from the shift tower to the transmission. A solenoid is mounted on the transmission and energized by means of a switch on the driver's instrument panel to engage a shift fork so that the shift into reverse gear can be made.

The transmission is splash lubricated by lubricant contained in the housing. A magnetic plug and oil filter are provided to remove any metal cuttings which may be present in the oil.

The four forward speeds are selected in the normal way, using the gear shift lever only. To shift into reverse gear the shift lever should be placed in NEUTRAL and the "Reverse" switch on the instrument panel engaged. The shift into reverse can then be made. As soon as the shift has been completed the "Reverse" switch should be allowed to return to the normal position.

CAUTION The reverse solenoid may be seriously damaged if the "Reverse" switch is held in the ON position longer than necessary, or if it is moved to the ON position when the transmission is in any of the forward gears.

It is not necessary to use the "Reverse" switch to shift out of reverse gear to neutral or a forward gear.

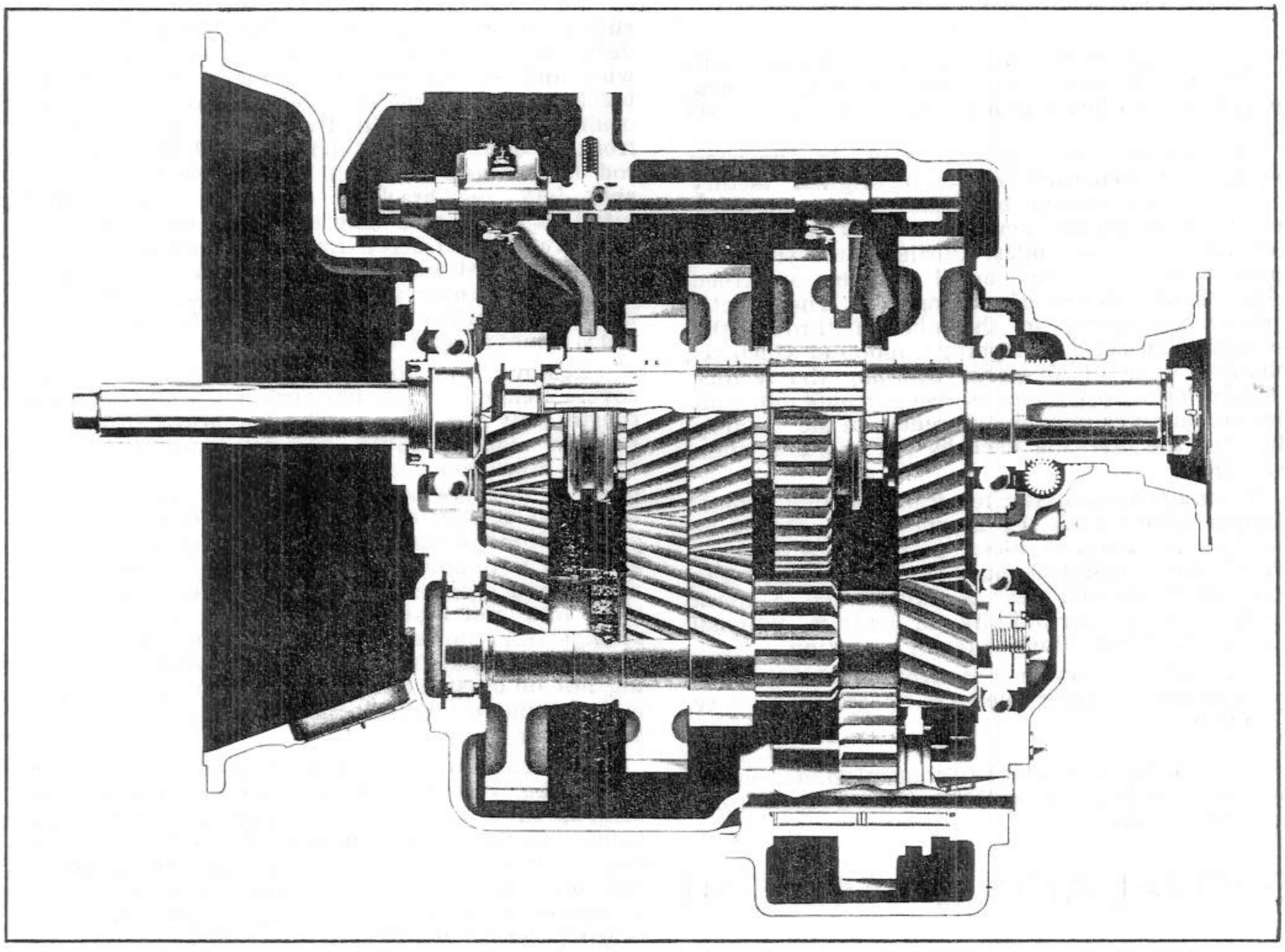


FIGURE 13 - 1: Transmission Cross-section

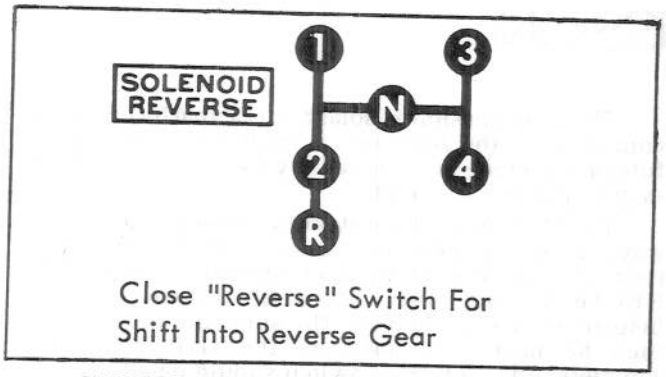


FIGURE 13 - 2: Shift Pattern

Back-up lights are automatically illuminated when the shift to reverse is made.

Information concerning the reverse solenoid will be found in Section 7 (Electrical) of this manual.

MAINTENANCE

At intervals indicated in Section 10 (Lubrication) of this manual, the transmission should be drained, flushed and refilled with a good grade of the correct lubricant.

To insure maximum life of the transmission and prevent premature failure, the original "factory fill" lubricant should be drained before putting vehicle into regular service or after 1,000 miles and not over 4,000 miles. During initial stages of normal operation, tiny metal particles are freed from mating surfaces of moving parts. These metal particles are carried by the lubricant through the assembly and act as a lapping compound which accelerates wear of all parts. Draining the factory lubricant prior to 4,000 miles also prevents lubricant contamination caused by differences in the "factory fill" and the lubricant used by the operator when topping.

When the transmission lubricant is changed, metal particles adhering to the magnetic plug should be removed. If excessive metal particles are found, a careful check should be made of the transmission to determine if unusual wear is taking place. A check should be made periodically for leakage, unusual noise or other indications of faulty operation.

For highway service it is recommended that the transmission oil filter element be changed every 15,000 miles.

Lubricant may be added to transmission through the dipstick tube. Appropriate marks on dipstick indicate the correct level.

REMOVAL AND REPLACEMENT

The engine unit should be removed as outlined in Section 8 (Engine). Remove propeller shaft. Support the transmission case securely. Remove cap screws which attach the transmission to the engine flywheel housing. Carefully slide transmission housing away from the engine until drive gear shaft is free of clutch plates.

CAUTION The transmission case must be moved straight away from the engine. Otherwise damage to the pilot shaft may result.

In re-installation, care should be taken to ensure that the pilot shaft is aligned with splines of clutch driven discs. Do not use excessive force to bring the engine and transmission case together. Refer to Section 5 (Clutch) for information regarding alignment of clutch driven discs in reassembly.

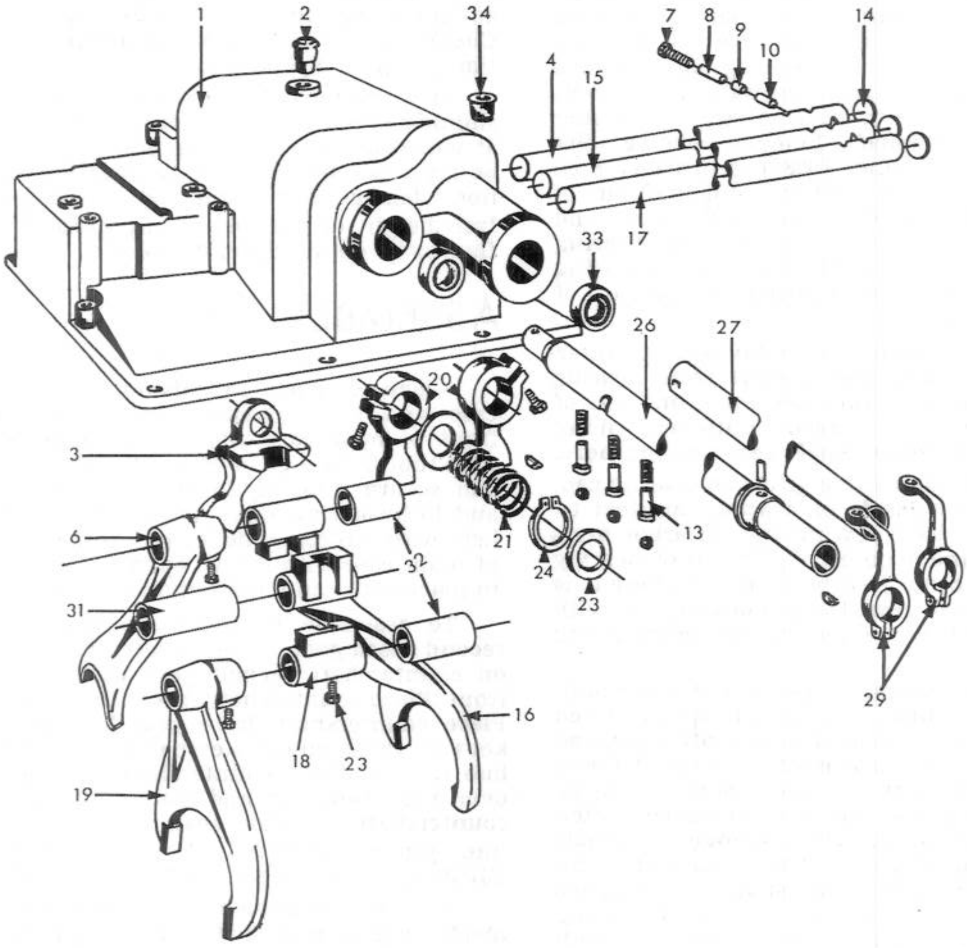
DISASSEMBLY

Shift transmission into reverse gear. Remove drain plug and drain lubricant. Remove stud nuts securing shifter housing to transmission case. Lift complete shifter housing assembly up clear of transmission.

To disassemble shift cover and shift forks, place shift cover and shift fork assembly up side down in vise. Remove interlock cross hole plug. Remove lockwire and set screws from reverse shift fork and brackets. Tap reverse shift rod out through front end of shift cover which will also force out welch plug in front of shift cover. Watch poppet ball when shift rod is removed as it will fly out. Remove reverse shift fork and bracket from cover. Remove long interlock from cross hole in side of cover. Remove lockwire and set screw from third and fourth shift fork. Tap third and fourth speed shift rod out front end of shift cover which will force out welch plug in front of shift cover. Watch poppet ball when shift rod is removed as it will fly out.

Remove third and fourth shift fork from shift cover. Remove small interlock pin from third and fourth shift rod. Remove short interlock from cross hole in side of cover. Remove lockwire and set screws from low and second speed shift fork and bracket. Tap low and second speed shift rod out front end of shift cover which will force out welch plug in front of shift cover. Watch poppet ball when shift rod is removed as it will fly out. Remove low and second speed shift rod from cover and remove shift fork and bracket. Remove the three poppet springs from holes in shift cover. Remove reverse relay shift fingers from side of shift cover by loosening nut on outside of cover and removing stud from cover. Remove reverse lock out plunger from relay shift finger.

To disassemble shaft, gears and bearings from main case, remove mainshaft rear universal joint companion flange nut. Pull universal joint companion flange from mainshaft. Remove cap screws from mainshaft rear bearing cap. Remove mainshaft rear bearing cap. Remove speedometer drive gear or spacer from mainshaft. Remove mainshaft rear bearing thrust washer. Slide mainshaft and gear assembly as far toward rear as possible. Place bearing puller on mainshaft rear ball bearing and pull bearing



1.	Housing S/A
2.	Breather
3.	Shift Finger - Reverse
4.	Rod - Reverse Shift
5.	Bracket - Reverse Shift Rod
6.	Fork - Reverse Shift
7.	Plug - Interlock Hole
8.	Interlock - Long
9.	Pin - Interlock
10.	Interlock - Short
13.	Plunger - Shift Rod Poppet
14.	Plug - Shift Rod Holes
15.	Rod - 3rd & 4th Shift
16.	Fork - 3rd & 4th Shift
17.	Rod - 1st & 2nd Shift
18.	Bracket - 1st & 2nd Shift Rod
19.	Fork - 1st & 2nd Shift
20.	Shift Finger
21.	Spring
23.	Thrust Washer
24.	Snap Ring
26.	Shaft - 1st & 2nd & Reverse Shift Finger
27.	Shaft - 3rd & 4th Shift Finger
29.	Shift Lever
31.	Sleeve - 3rd & 4th Shift Rod
32.	Sleeve - 1st, 2nd & Reverse Shift Rod
33.	Oil Seal - Shift Finger Shafts
34.	Filler Plug

FIGURE 13 - 3: Shifter Housing Assembly

off mainshaft and out of rear bore of case.

Remove clutch release yoke and clutch release shafts. Remove cap screws from main drive gear bearing cap. Place two puller bolts in holes provided in main drive gear bearing cap and pull bearing cap and main drive gear out front of main case by screwing in on puller bolts. Remove main drive gear pocket bearing from end of mainshaft. Mainshaft and gears can be removed from main case by lifting up front end of mainshaft first and slide it forward and lift it out of main case. Remove countershaft rear bearing cap screws and bearing cap. Remove countershaft rear bearing retaining washer cap screw. Remove countershaft rear bearing retainer washer from rear of countershaft. Remove reverse idler gear shaft by placing puller T45861 in threaded hole provided in reverse idler shaft and pull shaft out of case. Remove reverse idler gear and sleeve and bearing assembly. Remove countershaft rear bearing by sliding countershaft toward rear and place bearing puller on countershaft rear bearing and pull off of rear of countershaft.

To remove countershaft assembly, slide countershaft toward rear until countershaft front bearing is out of front bore in main case. Lift front end of countershaft up and slide forward until rear end of countershaft clears countershaft rear bearing bore.

To disassemble main drive gear and bearing cap, remove snap ring on inside of bearing cap next to main drive gear. Place bearing cap on arbor press and push bearing and main drive gear out of bearing cap. Unlock main drive gear bearing nut where it is peened to main drive gear. Loosen bearing nut with wrench T56086-3 Det. 1. Press main drive gear bearing off main drive gear.

To disassemble mainshaft gears and mainshaft, remove mainshaft third and fourth speed clutch collar from mainshaft. Remove mainshaft low speed gear and needle roller bearings from rear of mainshaft being careful not to lose needle bearings. Remove main shaft low and second speed clutch gear from rear of mainshaft. Remove mainshaft third and fourth speed clutch gear, mainshaft third speed gear and sleeve and mainshaft second speed gear can be removed from mainshaft by placing mainshaft and gear assembly under arbor press with rear end of mainshaft down and mainshaft second speed gear resting on bed of arbor press and press down on front end of mainshaft which will remove gears from mainshaft.

Care should be taken as needle roller bearings and third gear speed gear sleeve lock balls will fall out when removed from mainshaft.

To disassemble countershaft, place bearing puller on countershaft front roller bearing and pull bearing off front end of countershaft. Remove countershaft drive gear snap ring with snap ring spreader. Press off countershaft gears one at a time by placing gear on bed of arbor press and pushing countershaft out of gear.

Clutch bell housing does not have to be removed from main case, unless bell housing is damaged and has to be replaced.

To remove bell housing from main case, remove cap screws and lockwashers in bell housing and remove bell housing from main case.

REPAIRS

Clean all parts in solvent and inspect. Replace parts showing excessive wear. Gaskets, oil seals, cotter pins and lockwires usually require replacement. Check all clearances and adjustments using information given in "Specifications".

Ball bearings showing flaking, spalling or scoring should be replaced. Experience will dictate the period at which bearings showing only normal wear should be replaced. Do not spin ball bearings in dry condition - damage may result. Check springs for loss of free height or tension. If any question arises, use figures given in "Specifications".

ASSEMBLY

Clean all parts in solvent. To assemble main case and bell housing, place clutch housing in front of main case and line up main bearing bore with tool T43634-11 or main drive gear bearing cap, and secure housing to main case with cap screws and lockwashers. Coat power take-off opening gaskets with gasket cement and assemble on each side of main case with P.T.O. opening covers and secure in place with cap screws and lockwashers.

To assemble countershaft, place countershaft second speed gear key in countershaft keyway. Press on countershaft second gear with longest hub to front. Place countershaft spacer in keyway and press. Place countershaft drive gear key in countershaft keyway. Press on countershaft drive gear with longest hub to rear. Place countershaft drive gear snap ring over tool T47535-30 and place tool on front end of countershaft and slide snap ring down over tool and into groove provided in countershaft with tool T47535-30. Press on countershaft front roller bearing.

To assemble mainshaft gears and mainshaft, coat inside bore of mainshaft low speed gear with heavy grease and place two rows of needle roller bearings. (77 per row) on inside of mainshaft low speed gear with spacer between rows of needle roller bearings. Coat inside bore of mainshaft second speed gear with heavy grease. Place two rows of needle roller bearings (71 per row) on inside of mainshaft second speed gear with spacer between rows of needle roller bearings. Coat inside bore of mainshaft third speed gear with heavy grease. Place two rows of needle roller bearngs (71 per row) on inside of mainshaft third speed gear with spacer between rows of needle bearings.

Place mainshaft in vise with rear end down. Place mainshaft second speed gear and needle roller assembly over mainshaft with clutching teeth to rear of mainshaft. Place mainshaft third speed gear sleeve on mainshaft with flanged end of sleeve toward rear, line up the two notches on inside of sleeve with splines of mainshaft and place two sleeve lock balls in notches of sleeve on mainshaft with tool T47535-31, or proper size tube. Do not press on flange of sleeve. Place mainshaft third speed gear and needle roller bearing assembly on mainshaft sleeve with clutching teeth to front. Place mainshaft third and fourth speed clutch gear on front of mainshaft with hub of clutch gear to front and press in place with tool T47535-31 or proper size tube.

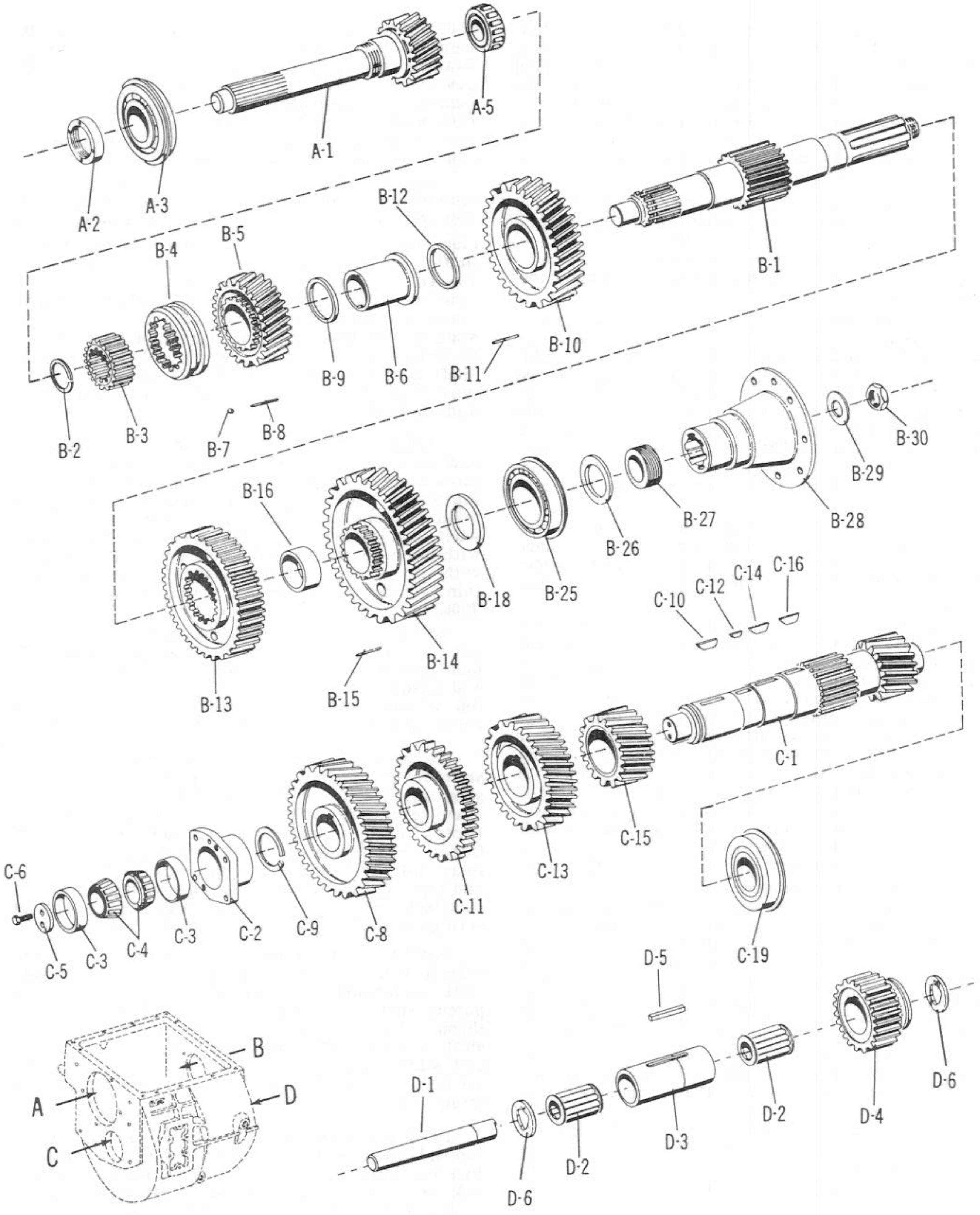

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FIGURE 13 - 4: Gears & Related Parts

Place tool T47535-30 on front end of mainshaft and slide third and fourth speed clutch gear snap ring over tool and press down into groove provided in mainshaft with tool T47535-30. Place third and fourth speed clutch collar on clutch gear with longest hub to the rear or toward mainshaft third speed gear. Remove mainshaft from vise. Place mainshaft low and second speed clutch gear with shift fork collar to rear, on splines of mainshaft.

Place mainshaft low speed gear and needle roller bearing assembly on rear of mainshaft with clutching teeth to front of mainshaft. Grease one side of mainshft low speed gear thrust washer and place on rear of mainshaft with greased side against low speed gear.

To assemble main drive gear and bearing cap, press main drive gear ball bearing on main drive gear with bearing shield toward gear. Assemble bearing lock nut on drive gear and tighten against ball bearing with wrench T56086-3. Lock nut by peening lock nut into two slots in stem of main drive gear. Place main drive gear bearing cap over main drive gear bearing and press into position. Insert snap ring into groove provided on inside of main drive gear bearing cap to hold bearing in bearing cap.

To assemble reverse idler gear and sleeve, place key in keyway of reverse idler gear sleeve and place reverse idler gear on sleeve and make sure it slides free. Place two roller bearings on inside of reverse idler gear sleeve.

To assemble gears and shafts in main case, place countershaft assembly in main case by lowering rear end of countershaft into case first and slide rear of countershaft through countershaft rear bearing bore and lower front end. Slide countershaft forward and line up front countershaft bearing with bore in case and tap rear of countershaft with soft hammer to enter bearing in case. Place countershaft rear ball bearing on countershaft with snap ring to rear and tap in place in case and on countershaft with tool T46242-66 or proper size tubing. Place small pin in hole provided in rear end of countershaft. Place countershaft rear bearing retaining washer on rear of countershaft and secure in place with cap screw and lockwasher.

Place reverse idler gear and sleeve assembly in case with shift fork collar of reverse idler gear to rear of case. Start reverse idler gear shaft through hole provided in case and line up reverse idler gear bearings with shaft and tap through bearings in sleeve and make sure flat on rear of reverse idler shaft is lined up so countershaft rear bearing cap will lock reverse idler shaft in place. Coat countershaft rear bearing cap gasket with gasket cement. Place gasket on rear of main case. Place countershaft rear bearing cap in place with protruding part to lock reverse idler gear shaft in proper location and secure bearing cap with cap screws and lockwashers. Assemble mainshaft and gears in main case by lowering rear end of mainshaft first and slide rear of mainshaft through mainshaft rear bearing bore of main case and then lower front end of mainshaft in place.

Place main drive gear pocket bearing on front end of mainshaft. Note: Bearing 421-5207-1 (Hyatt U-5207-YM) must be assembled on shaft with snap ring in outer race to rear. Coat main drive gear bearing cap gasket with gasket cement and place gasket on bearing cap. Place main drive gear and bearing cap assembly in front mainshaft bore in case with mark TOP on bearing cap to top of case and tap in place with a soft hammer. Secure bearing cap in place with cap screws and lockwashers.

Install clutch release yoke and release shaft in clutch housing and secure yoke to release shafts with key and thin head cap screws and thin lockwashers.

Place mainshaft rear ball bearing on rear of mainshaft with snap ring on outer diameter of bearing toward rear and tap in place on mainshaft and in case bore with bearing driver T46242-66. Place mainshaft rear bearing thrust washer on mainshaft and slide against bearing. Place speedometer drive gear on spacer, if speedometer gear is not used on mainshaft, next to thrust washer. Place speedometer driven gear lower bushing in rear mainshaft bearing cap and tap in place.

Install speedometer driven gear in bearing cap and secure in place with upper bushing and two cap screws and lockwashers. Coat mainshaft rear bearing cap gasket with gasket cement and install on rear of main case and line up oil drain holes. Install mainshaft rear bearing cap and line up oil drain holes with holes in end of main case and secure in place with cap screws and lockwashers. Press universal joint companion flange on mainshaft with pusher T36628-2.

Secure universal joint companion flange with flat washer, nut and cotter pin. Place clutch housing hand hole cover on lower opening of clutch housing and secure with two cap screws and lockwasher. Coat top of main case with gasket cement. Place shift cover and main case gasket on top of main case.

To assemble shift cover and shift fork, place shift cover housing in vise upside down and by standing in front of shift cover proceed as follows: Place reverse relay shift finger stud in shift finger. (Note - head of stud to be on same side as shift finger.) Place reverse lock out plunger in reverse relay shift finger. Place reverse shift finger in place and tap stud through shift cover housing and secure with lockwasher and nut. Place three shift rod poppet springs in holes provided in shift cover housing.

Slide first and second shift rod into right hand hole in front end of cover. Install first and second shift rod brackets on shift rod. Place poppet ball on poppet spring and hold down and slide shift rod through boss in cover. Place first and second speed shift fork on shift rod (longest hub toward front) and slide shift rod through into place. Line up set screw holes in shift fork and bracket with set screw positions in shift rod.

Place pointed set screws in shift fork and bracket and tighten set screws and lockwire set screws so wire does not interfere when shifting. Place short interlock in cross hole in shift cover and slide through to first and second shift rod. Slide third and fourth shift rod in center hole in front end of shift cover. Place small interlock pin in shift rod. Place third

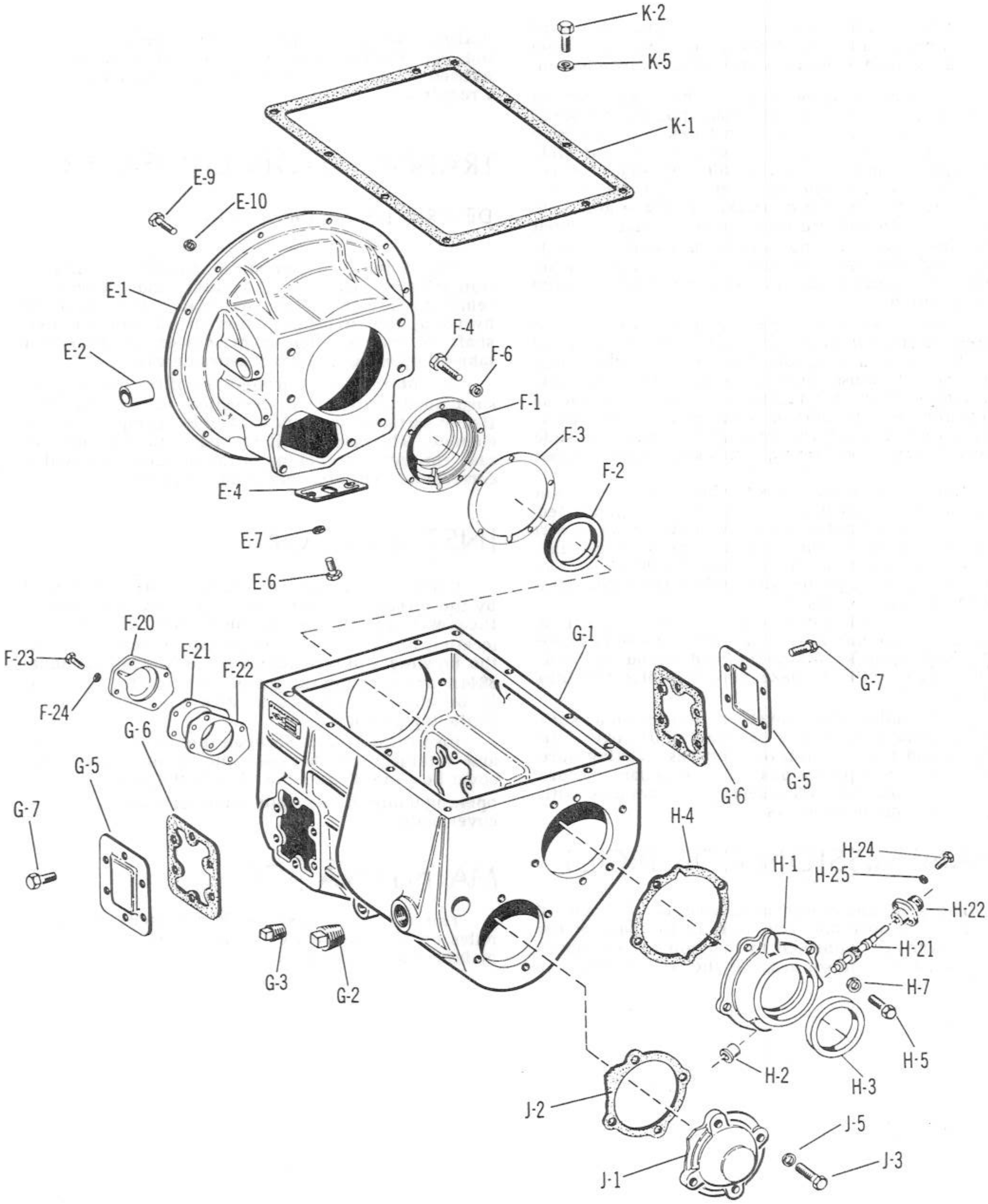
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FIGURE 13 - 5: Case, Bearing Caps & Related Parts

and fourth shift fork in position and slide shift rod through shift fork. Place poppet ball on poppet spring and hold down and slide shift rod into position.

Line up set screw hole in shift fork with set screw position in shift rod. Place pointed set screw in shift fork and tighten and lockwire. Place long interlock in cross hole in shift cover and slide through to third and fourth shift rod. Place reverse shift rod in last hole in front end of shift cover. Place reverse shift rod bracket in place and slide reverse shift rod through bracket. Place poppet ball on poppet spring and hold down and slide shift rod through and place reverse shift fork on shift rod (longest hub to front) and stick through into position.

Line up set screw hole in shift fork with set screw position in shift rod. Place pointed set screw in shift fork and tighten and lockwire. Place long interlock in cross hole in shift cover and slide through to third and fourth shift rod. Place reverse shift rod in last hole in front end of shift cover. Place reverse shift rod bracket in place and slide reverse shift rod through bracket. Place poppet

Line up set screw holes in shift fork and bracket with set screw position in shift rod. Install pointed set screws and tighten and lockwire set screws so wire does not interfere when shiftng. Install three shift rod hole welch plugs in front end of shift cover and expand welch plugs. Install interlock cross hole plug in side of shift covers.

To check shift cover, shift into reverse position and then try to shift into low or second speed to make sure that interlocks lock out low and second shift rod. Check each shift to make sure it shifts full into poppets.

To assemble shift cover on transmission, shift transmission into reverse gear and shift cover into reverse and place on top of main case making sure shift forks are in proper place in shift collars. Secure shift cover and shift fork assembly to main case with cap screws and lockwashers.

TRANSMISSION CONTROLS

The gearshift tower is located to the right of the driver's position. Two rails in the base of the shift tower are connected to two control rods which are linked to control arms of the transmission. In shifting transmission gears, control rods move fore and aft. Control rods are provided with clevises secured by jam nuts to give a range for adjustment if required.

TRANSMISSION OIL FILTER

DESCRIPTION & OPERATION

The filter is designed to improve the life of transmission bearings, bushings and sleeves by removing foreign and abrasive materials from the oil by using the pressurized flow of oil from countershaft or reverse idler gears adjacent to the power take-off opening in the transmission case.

As the oil flows through the filter housing, all suspended material is deposited in the element. Heavy particles are deposited in the sump below the element. The cleaned oil re-enters the transmission case through the opening in the retainer plate which corresponds with the core of the element.

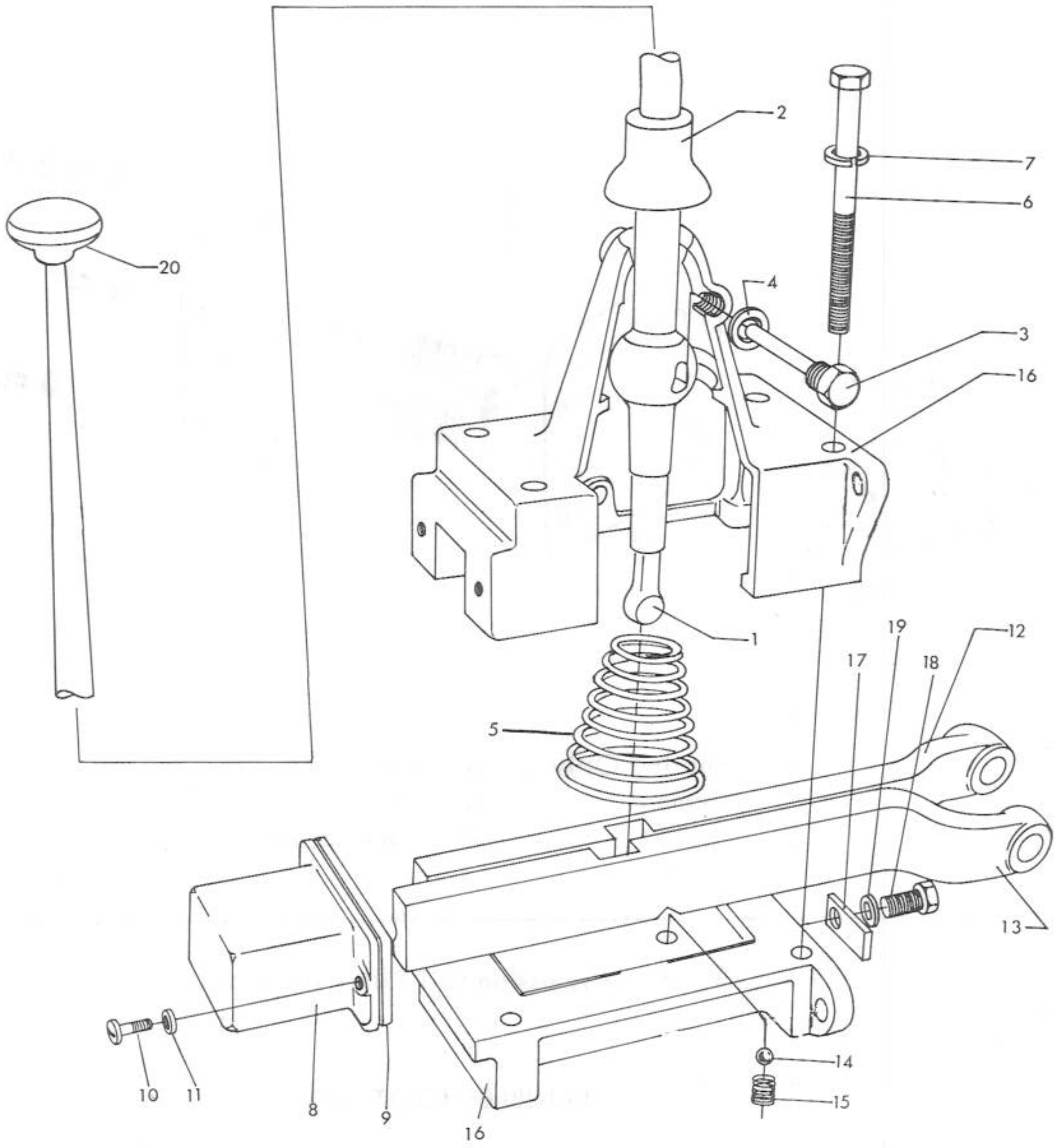
INSTALLATION

Correct installation of the assembly is identified by the direction of rotation of the gear adjacent to the power take-off opening and by the corresponding location of the word "TOP" which appears on both the housing and retainer plate. For the Spicer Model 8844A transmission the correct position for the filter is on the right-hand side with the word "TOP" in the top position.

Insert the gaskets between the transmission case and retainer and between the retainer plate and cover housing. Fasten the filter to the power take-off opening using the six bolts removed from the original cover plate.

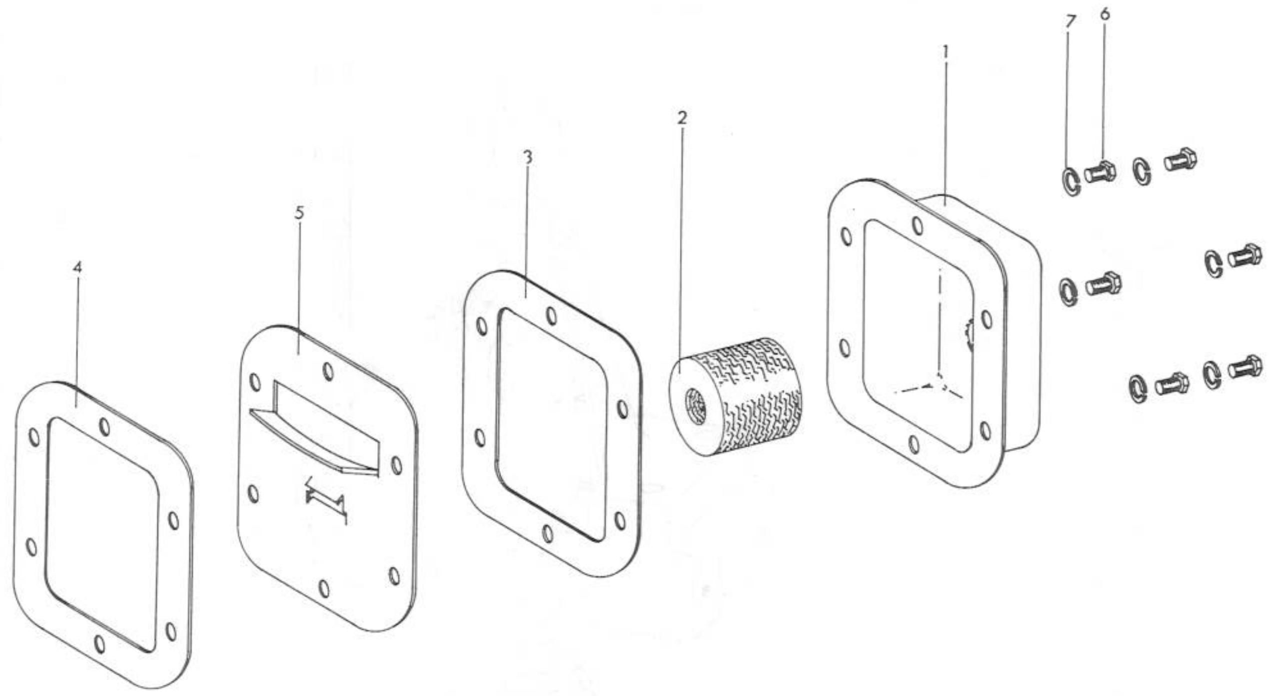
MAINTENANCE

The filter element should be replaced every 15,000 miles on highway service vehicles. No other periodic maintenance is required.



1. Shift Lever
2. Cover Grommet
3. Rocker Shaft
4. Lockwasher
5. Spring Support
6. Capscrew
7. Lockwasher
8. Cover
9. Gasket
10. Capscrew
11. Lockwasher
12. Shift Slide - First, Second and Reverse
13. Shift Slide - Third and Fourth
14. Poppet Ball
15. Spring
16. Control Housing
17. Lockplate
18. Capscrew
19. Lockwasher
20. Shift Lever Handle

FIGURE 13 - 6: Remote Control Shift Lever Assembly



1. Housing Only
2. Element
3. Gasket
4. Gasket
5. Plate
6. Screw
7. Lockwasher

FIGURE 13 - 7: Transmission Oil Filter Assembly

TROUBLESHOOTING

CAUSE	REMEDY
Noisy Transmission:	
Gears worn and pitted due to lugging engine with transmission in too high a gear range.	Replace gears.
Bearing worn due to lugging engine with transmission in too high a gear range, or to chips and dirt in oil.	Replace worn and rough bearings.
Gears on mainshaft having excessive end play.	Replace worn parts.

Transmission not lined up properly with engine and drive shaft.	Check alignment of transmission with drive line and rear axle.
Jumping Out of Gear:	
Shift rail poppet springs broken.	Replace poppet spring.
Shift rail poppet notch worn.	Replace shift rail.
Shift forks sprung or loose on shift rail.	Replace spring fork or tighten screw in shift fork.
Gear teeth worn.	Replace worn gears.
Gears not shifting fully into mesh.	Check shift rail to make sure spacers are not assembled in wrong position.
Transmission bell housing and engine flywheel housing not lined up properly.	Remove transmission and check engine flywheel housing for alignment and squareness with engine flywheel.
Excessive end play in mainshaft.	Check washer, speedometer gear or speedometer spacer. Tighten rear mainshaft nut.
Oil Leakage:	
Transmission overfilled.	Drain to proper level.
Breather stopped up.	Clean breather assembly.
Use of transmission oil that foams and expands when hot.	Drain and refill with high grade, properly refined, straight run mineral oil.
Drain back holes between bearing caps and main case stopped up.	Check drain holes and gaskets to make sure openings are clean.
Too much clearance between mainshaft and bearing cap oil screw-back.	Check clearance between shaft and bearings cap. Allowable clearance .010" to .015". Replace bearing cap if worn or damaged screw-back.
Broken gaskets.	Replace gaskets and use gasket cement.

SPECIFICATIONS

Ball and roller bearing fits on shafts and in bores are to ABEC-1 Tolerances. If questions of shaft and bore size arise, consult bearing book using tables for shaft revolving, housing stationary. These tables show a light press fit for the inner race and a push fit for the outer race. All ball bearings of same size use the same fits regardless of make. Roller bearings take slightly more liberal tolerances, but same type of fit. Fits referred to by name are:

Sliding: Part should slide freely but without considerable shake.

Running: The fit should allow clearance for heat expansion plus oil film. This is a maximum of about .003" (new) clearance on average size needle bearings in large transmissions, two or three thousandths more for bronze bushing fits.

Ball and roller bearing sizes shown do not indicate the internal fits as regards end play or radial clearance. Optional bearings of makes other than those shown are sometimes used. We caution against the installation of bearings from other sources than our authorized service manuals.

SPECIFICATIONS

Model number	8844A
Speeds	4-Forward, 1-Rev.
Mounting	On Engine
Gear Selection	Remote Control
Transmission Capacity	U.S. 10 qts. Imp. 8 qts.

GEAR RATIOS

First Speed	4.30
Second Speed	2.33
Third Speed	1.36
Fourth Speed	1.00
Reverse	6.00

GEAR BACKLASH

Mainshaft and Countershaft Gears	1st & 2nd: .006-.011; 3rd: .006-.008; Rev: .010-.013
Sliding Clutches and Clutch Gears	Rev., 1st & 2nd: .004-.007; 3rd: .004-.009

BEARINGS

Drive gear	Single row ball
Mainshaft (pocket)	Straight roller
Mainshaft (rear)	Single row ball
1st Speed Gear	2-Row Needle (77 per row)
2nd Speed Gear	2-Row Needle (71 per row)
3rd Speed Gear	2-Row Needle (71 per row)
Countershaft Front	Straight Roller
Countershaft Rear	Single Row Ball
Reverse Idler Gear Shaft	Straight Roller
Clutch Release Shaft	Bushing

MAINSHAFT GEAR BEARING ROLLERS

Number of rollers per gear	142
Length	.925/.920
Lapped Diameter	.12500/.12475

1ST AND 2ND SHIFT MECHANISM

Shift Fork to sliding clutch clearance	.005 - .016
Mainshaft Sliding clutches 3rd & 4th	.005 - .016
Reverse Gear Sliding Clutch	.005 - .016
Reverse Shift Shaft Spring	
Free Length	5-1/16
Lbs. Pressure 1-3/4 inch	40 lbs ± 2

CLEARANCES

Drive Gear Bushing & Sleeve	.004" - .006"
Helical Gear End Play - 1st Gear	.010" - .016"
Helical Gear End Play - Other	.008" - .013"
Front Bearing Cap & Drive Gear	.010" - .015"
Countershaft Gears - Press Fit	.001" - .003"
Mainshaft End Play (New bearing)	.000" - .015"

SPRING TENSION

Shift Rod Poppet Spring Free Height	1-7/32"
Shift Rod Poppet Spring Tension 1"	36lb-40lbs
Reverse Lockout Spring Free Height	2-1/32"
Reverse Lockout Spring Tension 1-5/8"	60 lbs

Service Bulletins

Service Bulletins will be issued from time to time to acquaint users with the latest service procedures. The number, date and title of such bulletins as pertain to this section should be noted below as soon as received. Bulletins should then be filed for future reference.

Number	Date	Subject

PROPELLOR SHAFT

DESCRIPTION

The propeller shaft transmits power from the transmission to the differential. It is of the tubular type, and uses two heavy duty needle-bearing type universal joints.

The slip joint compensates for variations in distance between transmission and differential brought about by the rise and fall of the rear axle as the vehicle passes over uneven surfaces. The slip joint also facilitates removal of the transmission or rear axle.

Each universal joint has a flange for attachment to the transmission and differential.

Steel spline drive shafts are installed in coaches with HT-70 automatic transmission only and have (10) ten splines. The glidecoat splines on drive shafts that are installed in coaches with the Standard Model 8844A and the automatic HT-740D transmission have (16) sixteen splines.

CAUTION: When assembling the permanent to the slip joint, the arrows must be in line at joining areas, this will align trunions. Refer to Figure 14-1.

MAINTENANCE

Both universal joints are provided with lubrication fittings. A third lubrication fitting is provided at the slip joint.

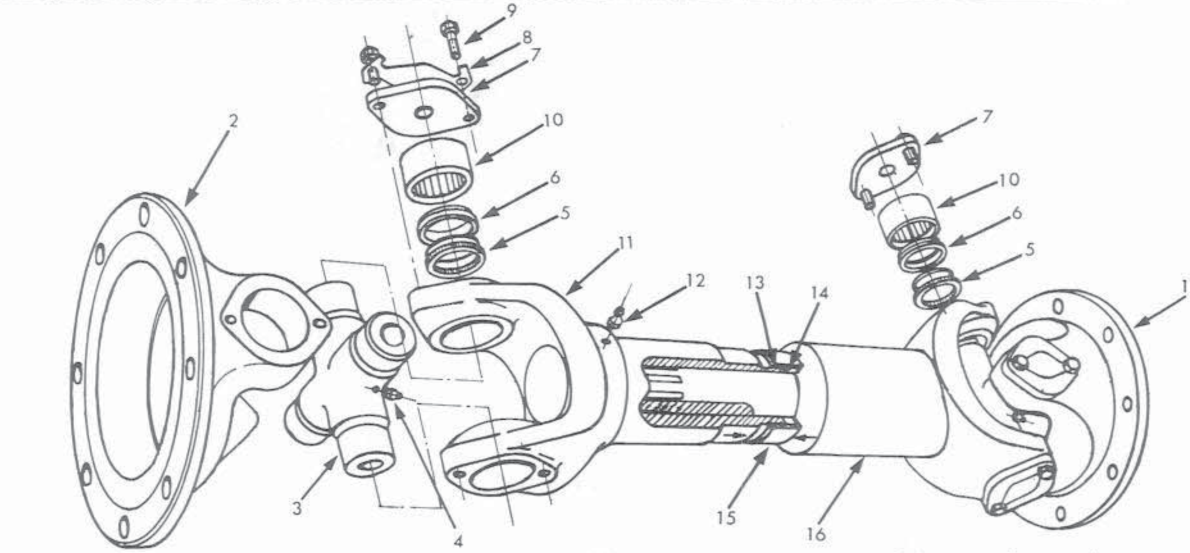
The propeller shaft lubrication fittings should be serviced according to the recommendations contained in Section 10 (Lubrication) of this manual.

Shaft flanges should be checked at regular inspection intervals for loose or broken bolts, lockwashers and nuts. When installing bolts, use only new 3/8" spring lockwashers to provide a proper lock. CAUTION: Do not re-use old lockwashers in this location: Only 14B-1-28 bolts are to be installed as they are a Grade 8 bolt with a longer than normal unthreaded section as shown in Figure 14-2: It is also important that only (19-3-162) Grade 8 hex nuts are installed on these bolts. The recommended torque of the nuts on bolts is 35 to 39 ft. lbs.

REMOVAL AND REPLACEMENT

The propeller shaft may be removed from the vehicle by removing the bolts which attach the universal joint flanges to the differential and transmission shafts. It is not necessary to disassemble the universal joints for removal of the propeller shaft assembly.

To remove the propeller shaft, remove nuts, bolts and washers which attach the propeller shaft flanges to transmission and differential shaft flanges. Unscrew the slip joint dust cap. Telescope the propeller shaft together at the slip joint. This shaft can then be removed.



2. Flange Yoke
3. Journal Cross Assy.
4. Zerk Nipple
5. Retainer - Journal Gasket
6. Gasket - Journal
7. Bearing Cap
8. Lock Strap
9. Capscrew - Bearing
10. Bearing Assy.
11. Sleeve Yoke Assy.
12. Zerk Nipple
13. Cork Washer
14. Steel Washer
15. Dust Cap
16. Permanent Joint Assy.
17. Flange Yoke

Figure 14-1: Propellor Shaft Assy.

DISASSEMBLY OF UNIVERSAL JOINTS

Bend tangs of lock plate. Unscrew bolts at universal joint bearings. Remove lock plate. Tap yoke until needle bearing assembly at opposite end drops out. Tilt center cross and remove. Do not permit needle bearings to drop on floor.

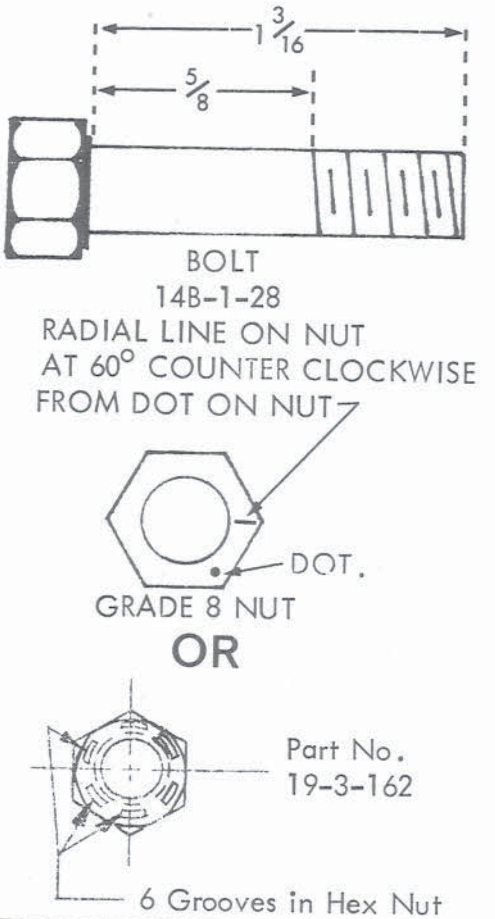


Figure 14-2: Propellor Shaft Flange Bolts & Nuts

CLEANING & INSPECTION

Thoroughly clean grease from bearings, journals, and other parts. Clean all lubricant passages in the journal, and the lubrication fittings. Needle bearing assemblies may be soaked in cleaning solution to soften particles of hard grease. It is extremely important that bearing assemblies be absolutely clean, since even very small particles of dirt or grit can cause rapid bearing wear. Do not attempt to disassemble needle bearings.

Bearing journal areas should be inspected for roughness or grooving. If light honing does not remove roughness, the entire bearing assembly should be replaced. Excessive wear of the needle bearings is indicated if the needles drop out of the retainer, or if marks are present on the journal bearing surface.

Inspect yokes for cracks, wear or distortion.

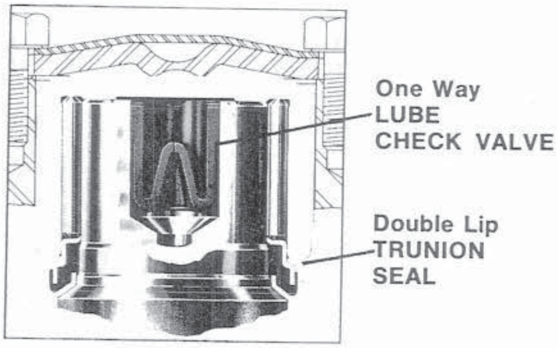
Universal joint repair kits are available for overhaul of these assemblies.

REASSEMBLY

Pack needle bearing assemblies with clean grease. Insert one trunnion of the journal into the yoke as far as possible from the inside, and tilt until opposite trunnion clears the yoke and drops into position. Install lubrication fittings and lubricate bearings approximately 1/3 full with the lubricant specified in Section 10 (Lubrication).

Insert bearing assemblies from outside of yoke and tap into place with plastic hammer. Do not use a steel hammer for this purpose. The joints should move freely, in the bearings and not bind. Also, if new needle bearing assemblies are not being installed, care should be taken to replace bearing assemblies in the same locations from which they were removed. Install bearing caps, new lock straps, and capscrews. Tighten capscrews firmly then lock screws by bending lock straps against screw heads.

1710 SERIES



Identifying features
Seal — Double lip pressed in bearing assembly.
Lube Check Valve in journal cross lube reservoir cavities.

LUBRICATION

UNIVERSAL JOINTS

To insure proper lubrication of all four bearing assemblies on universal joints, it is essential that mechanics add lubricant until it appears at all journal cross bearing seals. (Refer Figure 14-3). This assures removal of dirt particles and other contaminants that may find their way into the bearings and indicates to the mechanic that the bearings are fully lubricated.

Do not assume that bearing cavities have been filled with new lubricant unless flow is noticed around all four bearing seals.

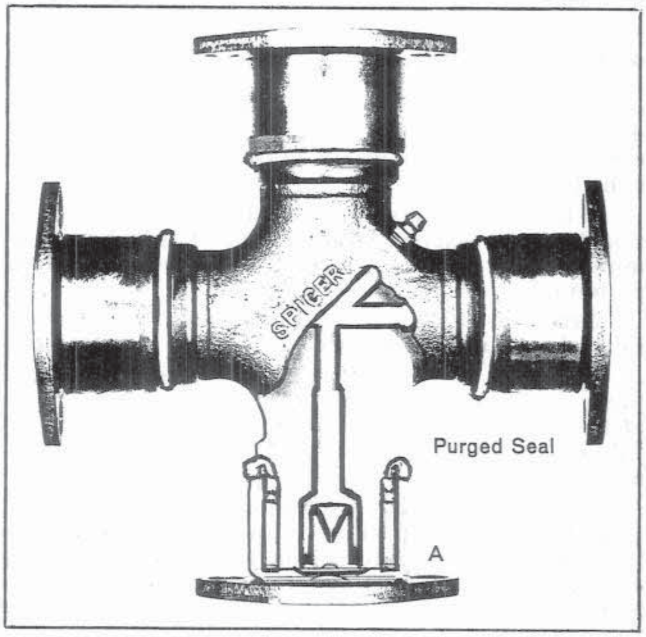


Figure 14 - 3: Journal Cross Assy.

Journal cross seals are designed to relieve. However, if all the seals do not "pop" when being lubed, move the driveshaft laterally in all four directions and pull or push on the drive shaft in the direction opposite to the journal cross seal not relieving while lube gun pressure is being applied to the alemite fitting. An increase in line pressure may also be necessary.

DRIVE SHAFT ASSEMBLY

Factory assembled drive shafts are lubricated at the plant prior to shipment. When installing spare parts replacement assemblies, it is recommended that all universal joints be relubricated after installation of the drive shaft prior to putting vehicle in service. High quality extreme pressure (EP) grease is recommended for universal joints. Lithium soap base greases meeting NLGI Grade 1 and Grade 2 specifications are preferred. The use of greases that tend to separate and cake should be avoided. Refer to Section 10 "Lubrication" for lubrication intervals.

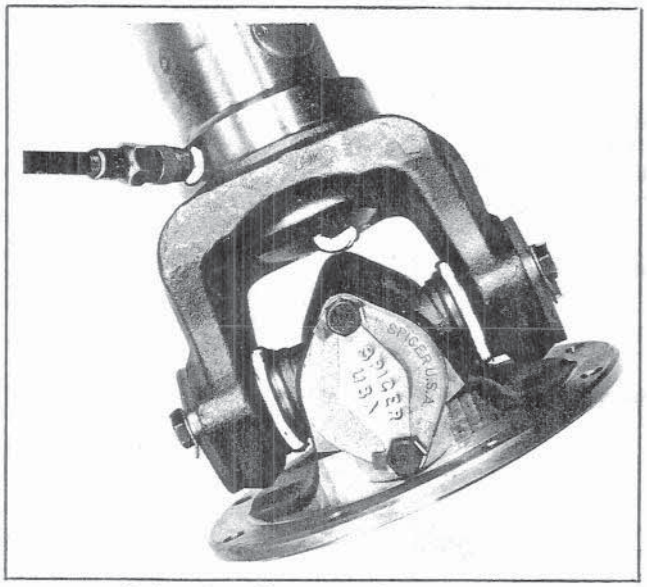


Figure 14 - 4: Sleeve Yoke End of Spline

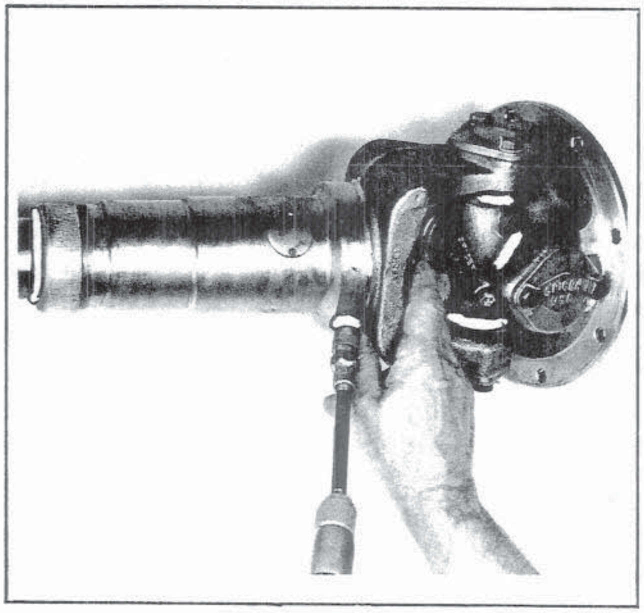


Figure 14 - 5: Sleeve Yoke Seal

RELUBE CYCLES

Relubrication cycles for drive shaft universal joints and slip splines vary with operating conditions. The following re-lubrication schedule has been used successfully.

OPERATING CONDITIONS	RE-LUBE CYCLE	
	Miles	Hours
Normal	6000-8000	150-200
*Severe	2000-3000	50- 75

*For applications where conditions such as high speeds, high ambient temperatures or high angles are present.

SLIDING SPLINE SECTIONS

LUBRICANTS

STEEL SPLINES: Driveshaft steel splines should be lubricated with mineral oil in the SAE-140-250 viscosity range or a good extreme pressure grease as recommended by lubricant manufacturers. Extreme pressure grease satisfying NLGI Grade 1 has been adopted as the standard.

GLIDECOTE TM SPLINES: Any high grade multi-purpose grease can be used.

Relube spline at the intervals prescribed above. Apply grease gun pressure to lubrication zerk until lubricant appears at pressure relief hole in welch plug at sleeve yoke end of spline. (Refer Figure 14-4). At this point, cover pressure relief hole with finger and continue to apply pressure until grease appears at sleeve yoke seal. (Refer Figure 14-5). This will insure complete lubrication of spline.

TROUBLESHOOTING

Noise and vibration in the drive line often originate in the propeller shaft. Noise and vibration originating in the universal joint and propeller shaft assembly appear only at certain speeds, and usually come and go as the vehicle speed is increased or decreased. Noises produced by the rear axle, on the other hand, are generally present throughout the vehicle's speed range.

When propeller shaft assembly noise and vibration becomes excessive, the cause should be determined and corrected immediately, since rear axle pinion failure is often a direct result.

Propeller shaft noise and vibration often appears to originate in the rear axle.

Common causes of propeller shaft and universal joint vibration are (a) propeller shaft assembly out of balance; (b) excessive flange runout or distorted yokes; (c) loose yoke nuts; (d) universal joint yoke misalignment.

If an out-of-balance condition is suspected, the assembly may be tested using a balancing machine. If a balancing machine is not available, the check may be made of each component of the assembly individually on the vehicle. Substitute one component at a time, road testing as each new part is installed. Continue this procedure until the entire assembly meets the required standard of performance.

SPECIFICATIONS

PROPELLER SHAFT	
Over all Collapsed Length (Not Installed)	
Model 8844A Standard Trans. (16 Splines)	34"
Model HT-740D Auto. Trans. (16 Splines)	23.50"
Model HT-70 Auto. Trans. (10 Splines)	19.562"
UNIVERSAL JOINT SERIES	
(Applicable with Models 8844A & HT740D Transmission)	
Slip Joint	No. 1711
Fixed Joint	No. 1718
UNIVERSAL JOINT SERIES	
(Applicable with Model HT-70 Transmission)	
Slip Joint	No. 1710
Fixed Joint	No. 1711
Bearing Type	No. 1710
BEARING ROLLERS	
Type	Needle
Number	36
Spline O.D.	2.50"
Spline Length	4.00

WHEELS, HUBS, TIRES

WHEELS

DESCRIPTION

Wheels supplied on Challenger coaches vary according to the specifications of the user. Wheels are of standard type and manufacture and may have either 2-piece or 3-piece rims. Either tube type or tubeless tires may be used.

Standard wheels are 20.00 x 8.00 for 11.50 x 20.00 tube-type tires or 22.50 x 8.25 wheels for 12.50 x 22.50 tubeless type.

The spare wheel and tire are carried in a compartment immediately behind the front bumper. Access is gained by loosening retaining bolts located directly beneath the bumper with a wheel wrench or by pulling out rubber lock from bumper door retainer. Bumper will lock in open position.

JACKING UP VEHICLE

DESCRIPTION

Whenever it is necessary to change a wheel when a flat occurs, the following procedures should be followed:

FRONT AXLE: Turn front wheels to extreme right or left, depending on which tire is flat, so that the front of the flat tire is turned outward. Run flat tire up on runup block. (Refer Figure 15-1). Run up block supplied in tool compartment. Apply parking brakes. Place jack under front jack pad and raise coach. Remove run-up block and proceed to change tire. Lower jack and remove from under jack pad.

REAR DRIVE OUTSIDE DUAL: To change outside dual, place wooden run-up block at inside tire. Drive vehicle onto block to raise outside dual off ground. Fully apply parking brakes and proceed to change tire.

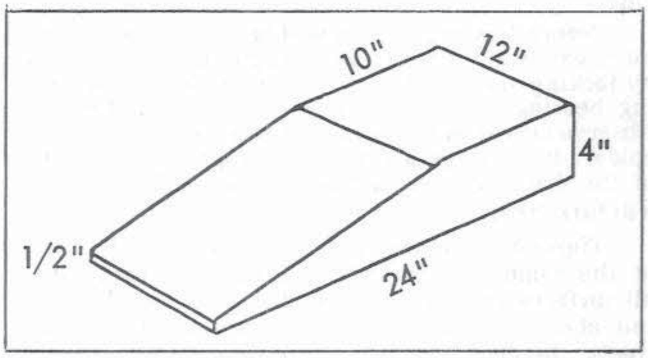


FIGURE 15 - 1: Run-up Block

REAR DRIVE INSIDE DUAL: To change inside dual-wheel, fully apply parking brakes. Position jack under rear jack pad. Jack up axle and proceed to change tire.

REAR TRAILING WHEEL: In case of a flat tire on the rear trailing wheels, release air pressure from bellows by turning the air release valve towards the rear of the coach until air is released from bellows. Position jack under jack pad and proceed to change tire.

NOTE: If no spare wheel is available for the rear trailing axle, the wheel should be raised and removed from axle. The hook-up link should be installed to hold up the axle. Reduce road speed to a minimum with axle in raised position.

WHEEL NUT TIGHTENING PROCEDURE

It is important that wheel stud nuts be tightened alternately on opposite sides of wheel. Refer to Figure 15-2 for suggested sequence for tightening and a recommended procedure following.

(A) Run the stud nuts in lightly referring to Figure 15-2 for sequence so that wheel will position itself concentrically with hub. This is important, otherwise wheel may be eccentric with hub and will not run straight. In this initial step, run the nuts up only as necessary to correctly position wheel.

(B) Tighten stud nuts progressively as shown in Figure 15-2 with an impact wrench. But final tightening should be done with a torque wrench. Tighten stud nuts to 450 - 500 ft. lbs.

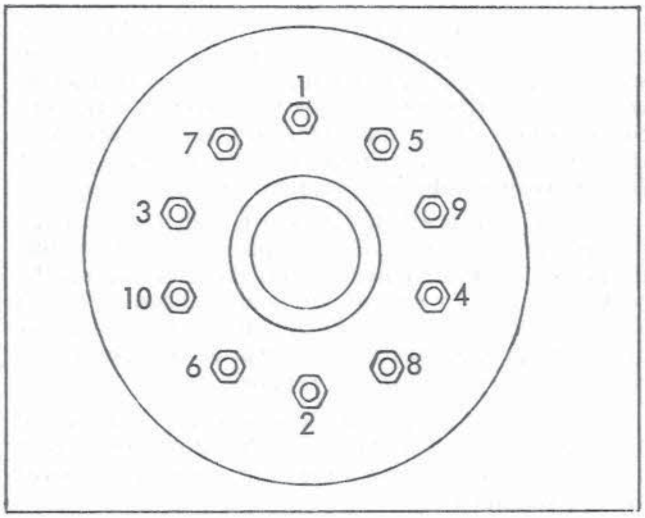


FIGURE 15 - 2: Stud Tightening Sequence

WHEEL MAINTENANCE

DESCRIPTION

Maintenance consists of periodic checks to see that wheel nuts are tightened to the proper torque. With a new coach, or after new wheels have been installed, stud nuts should be tightened every 100 miles for the first 500 miles to allow setting in of clamping surfaces.

Wheel studs and nuts must be kept free from grease and oil. No lubricant whatsoever should be used.

Cleanliness of wheel and drum mating surfaces is important for proper wheel mounting. On new drums the inner and outer surfaces of the mounting flange should be thoroughly cleaned to remove rust preventive coating.

Worn wheel stud holes will usually be accompanied by evidence of a bright worn surface on the wheel face, indicating that the loose wheels were working against each other. Wheels in this condition should be replaced. Inspect for hidden cracks in wheels, if cracked they should be replaced.

Check for stripped threads on wheel studs. When damaged threads are discovered, the stud should be replaced. When a broken stud is replaced, the studs on each side of it should be replaced. This is because the other studs in the wheel have been subject to undue strain. When damaged inner or outer cap nuts are found it is an indication of a loose mounting condition. Cap nuts and studs, if necessary, must be replaced. If wheel ball seats are damaged, the wheel also should be replaced. Corrosion or galling of the stud and nut assembly can reach a point where removal of cap nuts is difficult. If this is a persistent problem, a light application of lubricant can be applied on the first three threads of the stud and the first three threads of inner cap nut. Care should be taken to keep all lubricant from ball seat of stud hole or ball faces of cap nuts.

In case of a broken, cracked or worn hub face, it should be replaced. A badly worn hub face is always caused by running wheel assemblies in a loose condition. If the wear is not too excessive, the entire hub face can be machined to a flat surface with the studs removed. Otherwise, with a badly out of flat or worn condition, the hub should be replaced.

Broken or cracked rings are generally caused by rough use of tire tools or improper initial seating in gutter of rim. When found, the ring should be replaced. Bent or sprung rings are caused by rough and improper removal of this part and cannot be properly sprung back so as to seat accurately in the rim gutter. They should be replaced.

When mounting rear dual wheels, care should be taken to position the tire valve stems 180° apart so that access to both inner and outer tire valves may be obtained.

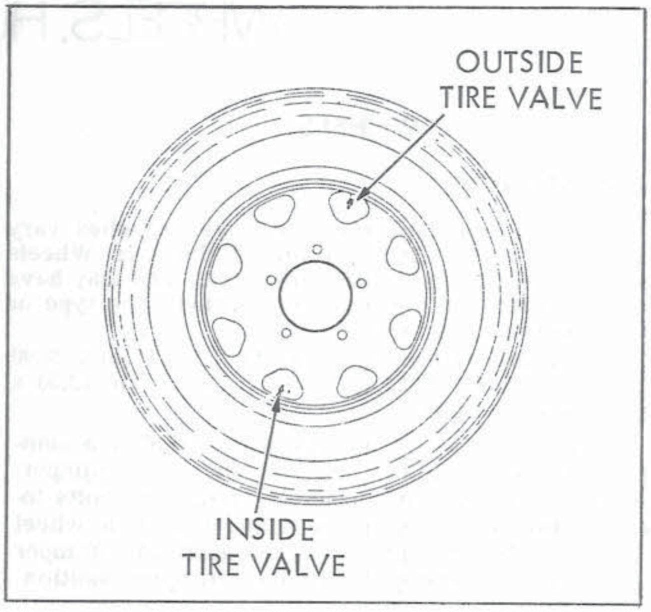


FIGURE 15 - 3: Proper Tire Valve Positions

(FRONT & REAR TRAILING WHEELS)

DESCRIPTION

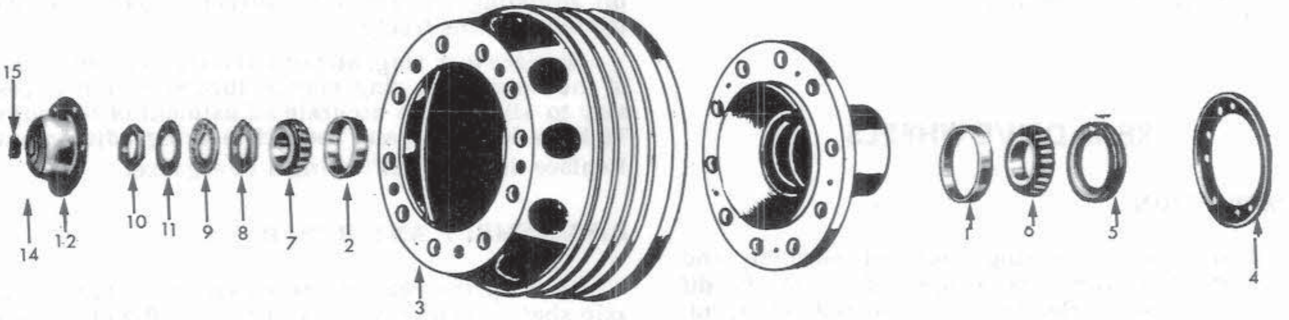
Front and rear trailing wheel hubs use oil lubrication which eliminates periodic repacking of the hubs. A sight glass is provided for convenient check of oil level. Level should be checked daily; if not visible in the sight gauge level mark, sufficient SAE #30 engine oil should be added through the composition snap plug at the center of the hub cap to bring level to the correct point. Use SAE #30 engine oil in front and trailing wheels.

ADJUSTMENT

To adjust front wheel bearings, remove cap screws, lockwashers, hub cap, and gasket. Flatten lock nut retainer and remove lock nut, and lock nut ring.

Before bearing adjustment is made, brakes must be released and not drag. Bearing play may be checked by jacking up the wheels one at a time and observing bearing play using a long bar under the tire. Observe movement of brake drum in relation to brake spider. If bearings are adjusted properly, movement of the drum will be just perceptible and the wheel will turn freely.

Tighten adjusting nut until the wheel binds, at the same time rotating the wheel to make sure all surfaces are in proper contact. Back off adjusting nut about 1/8 turn to make sure the wheel turns freely. Replace lock ring with valve pin in adjust-



1. Cup - Inner Wheel Bearing
2. Cup - Outer Wheel Bearing
3. Brake Drum
4. Oil Slinger - Wheel Bearing
5. Oil Seal Assy.
6. Cone - Wheel Bearing Inner
7. Cone - Wheel Bearing Outer
8. Nut & Dowel Assy.
9. Lock Ring
10. Jam Nut
11. Lock
12. Hub Cap (Visual Type for Oil Seals)
14. Capscrew - Hub Cap
15. Oil Filler Plug

FIGURE 15 - 4: Front & Rear Trailing Hub & Drum

ing nut inserted in the hole of the ring. Install new lock nut, lock ring, and draw nut up tight. Recheck bearing adjustment. Bend lips of new nut lock over flats of lock nut. Replace gasket and hub cap using new gasket and lockwashers.

DISASSEMBLY AND REPAIR

If bearings are to be removed, jack up front of vehicle and remove wheel. Remove brake drum-to-hub retaining screws and remove brake drum. Remove hub cap and gasket. Remove lock nut, nut lock, lock ring and bearing adjusting nut. Pull hub assembly off spindle being careful not to let the bearing fall out of hub. The oil seal and bearings can now be removed from the hub.

All parts should be thoroughly cleaned. Bearing cone and roller assemblies can be cleaned in a suitable cleaning solvent using a stiff brush to remove old lubricant.

If excessive wear, deterioration, cracking, or pitting are present on the bearing cups, rollers, or cones, the bearings should be replaced. Seals should be inspected for wear, deterioration, distortion, or damage at the sealing surfaces. Defective seal assemblies should be replaced.

OIL SEAL INSTALLATION
(FRONT & REAR TRAILING WHEELS)

PROCEDURE

Remove any nicks and burrs from spindle shoulder and apply liberal coat of C/R Boretite sealant or equivalent to spindle shoulder O.D. Install new spacer. This is required on initial installation only, as Scotseal does not rotate on spacer. Make sure new spacer press fit securely to spindle shoulder.

Bolt C/R centering plate 426S to hub. Use holes indicated for 6" BC. Bolts need only to be finger tight.

Optional: Drill 1-1/16" hole through center of grease hub cap and use instead of C/R 426S for centering.

Turn wheel over. Remove any nicks or burrs from the bore of the hub. Lightly coat the bore of the hub with C/R Boretite, or equivalent. Insert the assembly tool rod (cotter pin end) in the center hole of the centering plate. Lubricate inner bearing cone and insert into the cup.

Slip C/R Seal Adapter, 4455, over the rod and rest it on the seal so that the lip of the adapter fits over the outside of the seal. Using the striker (sliding hammer) drive the seal into the bore until it bottoms.

Remove tool and centering plate and wheel is ready to assemble on the axle. When installing wheel on the spindle, center the wheel hub with spindle to avoid damaging seal with end of spindle. Push wheel straight over spindle until ID of Scotseal pressfits over spacer. Pre-fill hub cavity with SAE-30 engine oil. Lubricate outer bearing cone and assemble. Adjust bearings and lock.

Bolt on Hub cap, C/R gasket. Remove rubber fill plug and fill hub with oil so that not more oil is visible in window level mark when final level is reached. Insert rubber fill plug.

REAR DRIVE WHEELS

DESCRIPTION

Rear hubs use a single oil-seal assembly and are lubricated from the supply of oil in the differential housing. Bearings are tapered roller, adjustable for wear. Refer to Figure 15-5:

Rear hubs require no periodic checking of lubricant level, provided correct level is maintained in the differential housing.

BEARING ADJUSTMENT

To adjust rear wheel bearings, jack up rear of coach and remove rear axle shaft as indicated in Section 2 (Rear Axle) of this manual. Remove gaskets, unscrew lock nut and remove adjusting nut lock ring.

To make the adjustment, tighten adjusting nut until the wheel binds, rotating the wheel while tightening so that all surfaces are in proper contact. Back off adjusting nut about 1/8 turn to make sure that the wheel turns freely.

Replace lock ring, and adjust nut dowel pin in one of the holes. The ring may be turned over if necessary to allow more accurate adjustment of bearings. Tighten lock nut and recheck bearing adjustment. Replace the axle shaft using a new gasket.

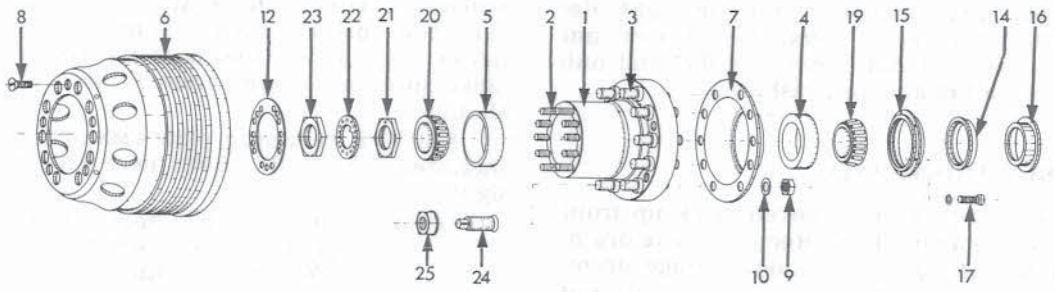
DISASSEMBLY AND REPAIR

Jack up the rear of the coach and remove rear axle shaft. Remove wheels and tires. Remove brake drum-to-hub retaining screws and remove brake drum. Remove lock nut, lock ring, and adjusting nut from axle housing making sure to prevent the outer bearing from falling out. Remove outer bearing cone and roller assembly.

Remove screws attaching inner oil seal retainer to hub, and remove inner oil seal assembly. Remove inner bearing cone and roller assembly. Bearing cups can be removed from the hub using a hammer and a long brass drift.

All parts should be thoroughly cleaned. Bearing cone and roller assemblies can be cleaned in a suitable cleaning solvent using a stiff brush to remove old lubricant.

If excessive wear, deterioration, cracking, or



1. Hub, Cup & Stud Assembly
2. Stud - Hub & Axle Shaft
3. Stud - Hub & Wheel
4. Cup - Inner Wheel Bearing
5. Cup - Outer Wheel Bearing
6. Brake Drum
7. Oil Slinger - Brake Drum
8. Screw - Brake Drum and Hub
9. Nut - Hub & Drum Stud
10. Washer - Hub & Drum Stud
11. Axle Shaft
12. Gasket - Axle Shaft
14. Oil Seal Assembly
15. Retainer
16. Wiper
17. Retainer Screw
18. Gasket - Wheel Bearing Oil Seal Retainer
19. Cone - Wheel Bearing Inner
20. Cone - Wheel Bearing Outer
21. Nut - Wheel Bearing Adjusting
22. Washer
23. Nut
24. Nut - Rear R.H. Inner Wheel to Hub
25. Nut - Rear R.H. Outer Wheel to Hub

FIGURE 15 - 5: Rear Drive Hub & Drum

pitting are present on the bearing cups, rollers, or cones, the bearings should be replaced. Seals should be inspected for wear, deterioration, distortion, or damage at the sealing surfaces. Defective seal assemblies should be replaced.

OIL SEAL INSTALLATION
(DRIVE WHEELS)

PROCEDURE

Lubricate inner bearing core and insert into cup. Place C/R Scotseal (14) Figure 15-5 squarely on edge of the retainer seal bore. Insert the assembly tool rod (cotter pin end) in the center hole of the hub bar.

Remove any nicks or burrs from axle housing seal shoulder and apply generous coating of C/R Boretite, or equivalent, to the spindle shoulder O.D. and face. Install new wiper ring (16) refer Figure 15-5. This is required on initial installation only, as Scotseal does not rotate on wiper.

Remove any nicks or burrs from bore of seal retainer. Reassemble retainer to hub using standard gasket and C/R Boretite sealant, or equivalent. Sealant is applied to retainer face only.

Bolt C/R Hub Bar 443S to hub so that central hole is centered. Use two flange nuts—finger tight. Turn wheel over. Coat the seal bore of the retainer with C/R Boretite sealant, or equivalent. Slip C/R Seal Adapter, 445S, over the rod and rest it on the seal so that the lip of the adapter fits over the outside of the seal. Using the striker (sliding hammer) drive the seal into the retainer bore until it bottoms.

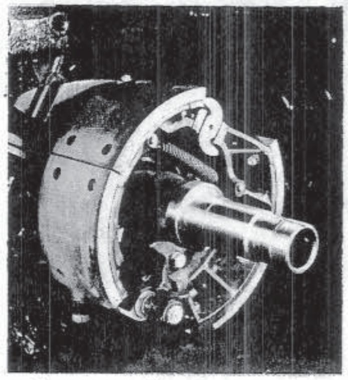
Remove tool and hub bar and wheel is ready to assemble to axle. When starting wheel on the sleeve spindle, center the wheel hub with spindle to avoid damaging seal with end of sleeve spindle. Push wheel straight over sleeve spindle until ID of Scotseal pressfits on wiper. Pre-fill hub cavity with SAE-140 differential oil. Lubricate outer bearing cone and assemble. Adjust bearings according to bearing manufacturer's recommendations, and lock.

Assemble axle flange to axle using gasket (12) refer Figure 15-5. Use C/R Boretite sealant, or equivalent, in stud area.

With axle flange filler held in six o'clock position, fill hub until **final level** is even with hole. Insert and tighten plug securely. (1 qt. of oil). To complete filling operation, after both wheels have been assembled and filled according to above procedure, raise the differential oil level to proper factory recommended level. Clean vent thoroughly.

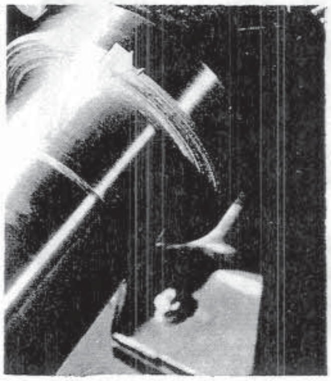
NOTE: During regular inspection check lubricant level in wheels and differential. Clean and replace vent as required.

STEPS FOR INSTALLING SCOTSEALS



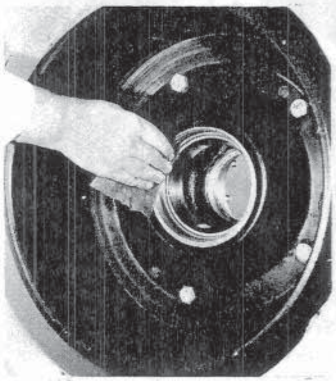
Clean spindle. Remove and discard all old wear sleeves if used previously for grease.

STEP 1



Seal shoulder must be smooth. Remove burrs with emery cloth or file.

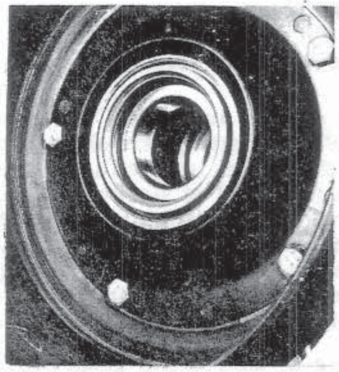
STEP 2



Remove all burrs from seal bore. If converting from grease, clean wheel cavity.

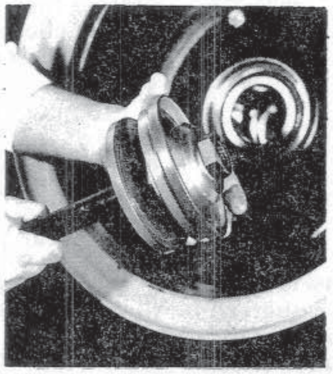
STEP 3

STEPS FOR INSTALLING SCOTSEALS (Cont'd)



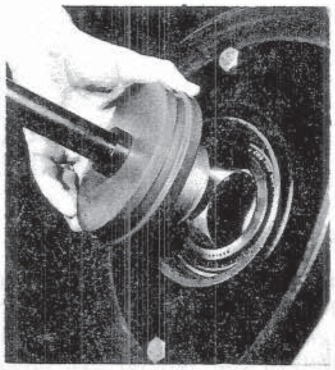
Dip or spray inner bearing cone with oil and position cone in cup.

STEP 4



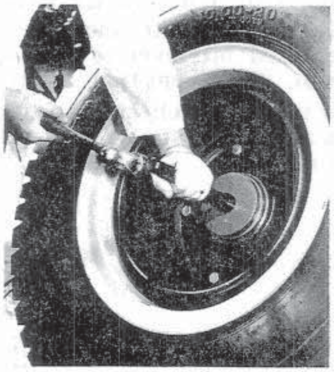
Seat small OD of Scotseal in recess of proper tool adapter (identified on every box).

STEP 5



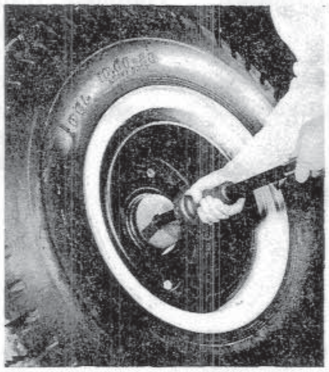
Insert centering plug in bore of inner bearing cone. This prevents cocking of seal.

STEP 6



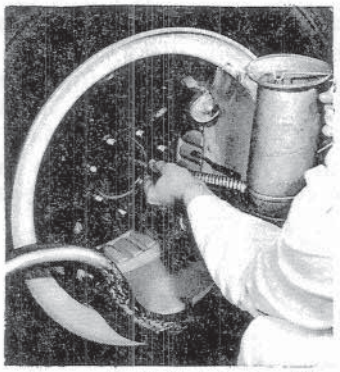
Hold tool handle firmly and strike with 3 to 5 lb. hammer with seal bottoms out.

STEP 7



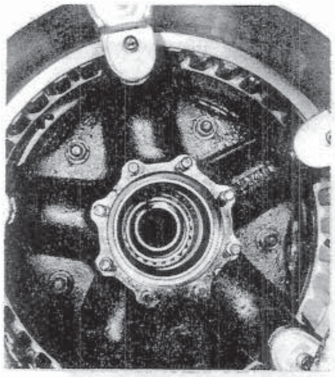
Or use production - type slide hammer. Hold firmly to avoid unseating tool adapter.

STEP 8



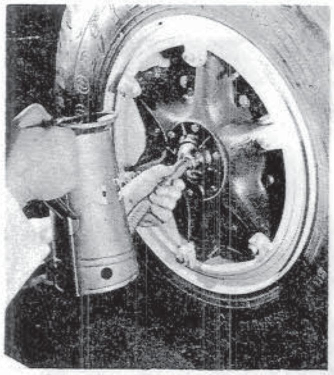
To speed initial lubrication, fill wheel cavity between bearing cups with oil.

STEP 9



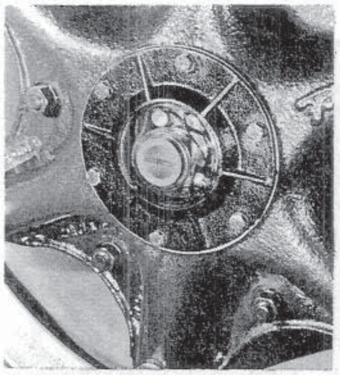
In assembling wheel on the spindle, be sure hub is in line to clear edge of spindle.

STEP 10



Add oil through filler hole in Scotseal hub cap.

STEP 11



Install filler plug to complete installation. NOTE: Oil level — do not overfill.

STEP 12

TIRE MAINTENANCE

DESCRIPTION

A regular and correct maintenance procedure is essential for safe and economical tire service.

Daily, inspect each tire carefully for cuts or foreign matter such as nails, glass etc. Remove any foreign matter lodged between tires on dual wheels. Check tire inflation pressure with an accurate gauge. Pressure should be checked before starting a run and should be as recommended by tire manufacturer. Always use same gauge to check the pressure to eliminate any differences resulting from gauge error.

If pressure loss is greater than normal, remove and inspect tire to determine cause. Replace any missing valve caps.

NOTE: Tire pressure should be taken with pressure cold.

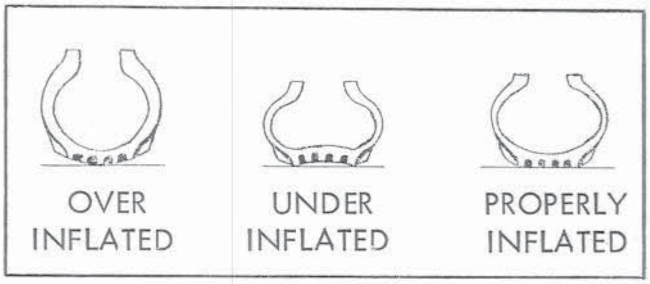


FIGURE 15 - 6: Tire Sections

Tires should be interchanged at regular intervals to obtain maximum life. Change wheels without dismounting tires so direction of rotation will be reversed.

If the inside tires show more wear than the outside dual tires, place front tires on inside when changing. In this case, outside dual tires can be interchanged between right and left-hand side of vehicle.

If the outside dual tires show more wear than the inside dual tires, place front tires on outside when changing. At the same time, interchange right and left-hand inside duals.

New tires should be installed on front wheels where they run coolest.

Baggage should always be placed as far to the rear as possible. This tends to put the load on the rear axle and reduces front tire stress.

VALVE CORES AND CAPS

DESCRIPTION

The valve core is a spring loaded check valve in the valve stem permitting inflation or deflation of the tube. The valve is provided to seal the air in the tube. When valve cap is tightened down on the stem, the sealing washer inside cap is pressed tightly against top of stem, preventing air leakage.

SPECIFICATIONS

Wheel Size — Tubeless	22.50 x 8.25
Tire Size — Tubeless ("G" Rated)	12.50 x 22.50
Wheel Size — Tube-Type	20.00 x 8.00
Tire Size — Tube-Type ("G" Rated)	11.50 x 20.00
Wheel Stud Torque	450-500 ft. lbs.

HEATING & AIR CONDITIONING

HEATING SYSTEM

The coach is provided with a hot water forced-air heating system which uses the engine cooling medium for heating the interior of the vehicle and windshield defrosting. Two heating radiator cores are provided, one for the main interior heating system and one for the driver's heater and defroster.

A complete air conditioning system is installed as standard equipment. The same duct system is used for both air conditioning and heating.

Flow of hot water to the main heater core is controlled by an electric water valve. A manually-operated water valve controls the flow to the driver's heater core. In the engine compartment, manually-operated shut-off valves are provided to isolate the heating system in the event of system failure or when the cooling system is to be drained.

A temperature sensing unit is located in the return air duct and, through relays, controls the main heater water valve within limits selected by means of the heat control dial on the driver's panel.

EMERGENCY VENTILATION

The coach is equipped with controls to introduce fresh air into the coach in the event of air conditioning system failure.

Two emergency ventilation air intakes are provided at the front of the coach inside the destination sign box. To open the intakes, turn knobs clockwise; counter-clockwise to close. Emergency exhaust is achieved by opening fully the "FRESH AIR INTAKE" controls in the front baggage compartments.

The emergency ventilation controls are intended for use only to enable the vehicle to reach a service point in case of air conditioning system failure. Cause of air conditioning loss should be located and corrected before further operation.

When trouble has been corrected, make sure that emergency ventilation controls are returned to the normal operating positions.

MAINTENANCE

At intervals depending entirely on service conditions, the air filter should be removed and washed. To reach the filter, open the right front baggage compartment door and the blower compartment door. The filter is provided with a handle for removal.

When the cooling system is drained and flushed (refer to Section 6, Cooling), the heating water system should be similarly serviced.

DRAINING & REFILLING

Refer to Section 6 (Cooling) for instructions on draining and refilling the engine cooling and coach heating system.

If the heating system is to be drained without draining the engine cooling system, close gate valves in engine compartment and drain radiator cores. A manual vent plug is provided in the top of the driver's heater core and in the main heater core for bleeding air while refilling. The vent plugs allow air to enter during draining.

OPERATION

Controls for the coach heating system are located at the driver's switch panel. The temperature control selects the temperature range desired and the system automatically maintains the pre-set limits. Blower motors for coach heating, driver's heater and defroster are controlled by switches on the driver's switch panel.

MAIN HEATER WATER VALVE

DESCRIPTION

The flow of hot water to the coach main heater core is controlled by an electric water valve mounted in the right front baggage compartment.

The valve is so designed that the pilot valve within the assembly opens and closes a port which directs pressure to either the top or bottom of the valve diaphragm, thus opening or closing the valve.

A delay action is built into the water valve through a means of an orifice in the valve body and a modulating cup on the diaphragm assembly. When the coach is operating with no current to the water valve solenoid, inlet water pressure is directed to the upper side of the diaphragm, thus forcing it open.

The pilot valve is normally open, relieving any build-up of pressure under the diaphragm. When the solenoid is energized the pilot valve closes, water pressure builds up through the orifice to the under side of the diaphragm and keeps the valve in closed position.

REMOVAL AND REPLACEMENT

To remove the valve, close manual water valves located behind the alternator and R.H. side engine compartment. Disconnect water connections to the valve and electrical connection. Remove attaching nuts and remove valve.

Replacement procedure is the reverse of removal.

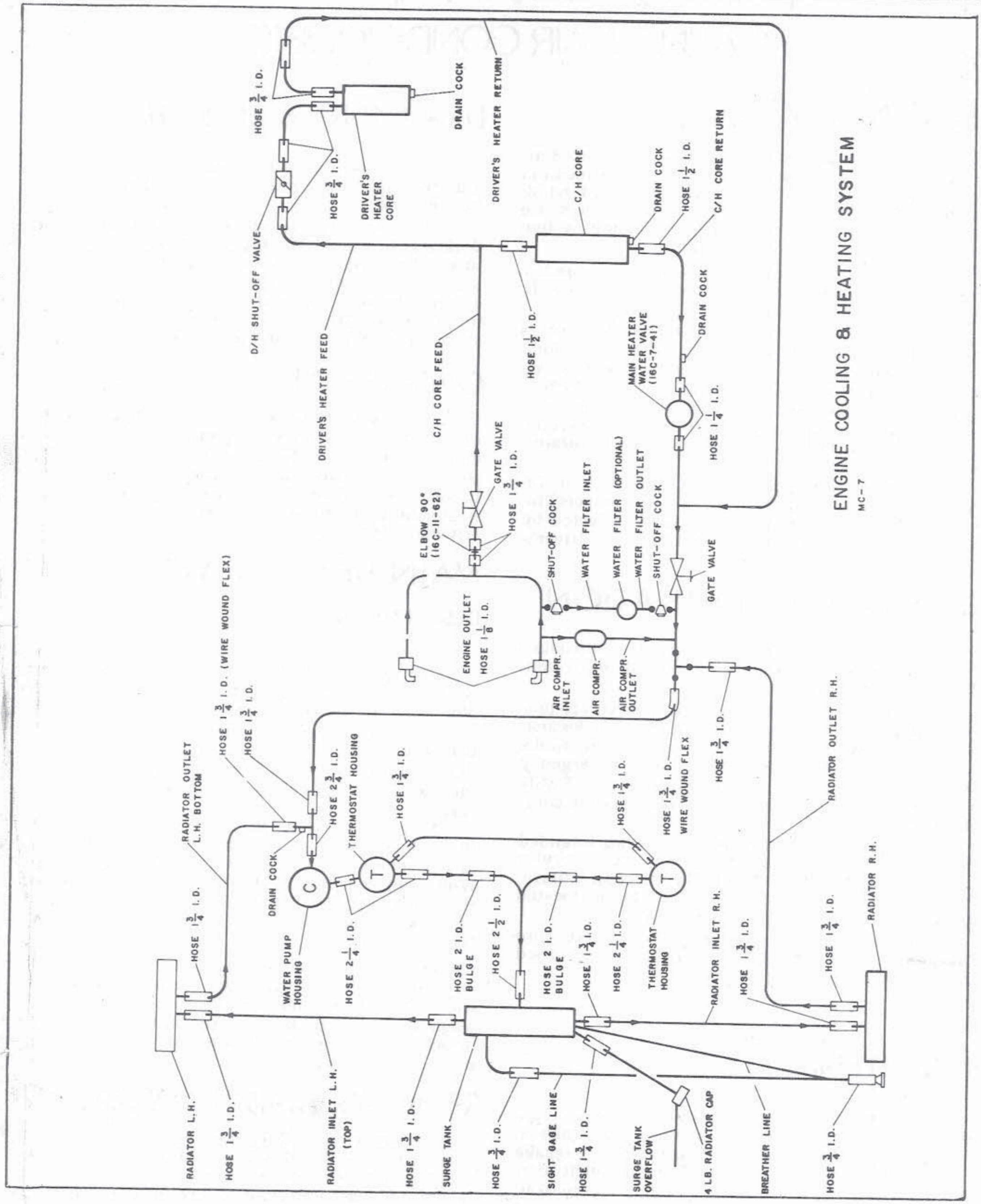
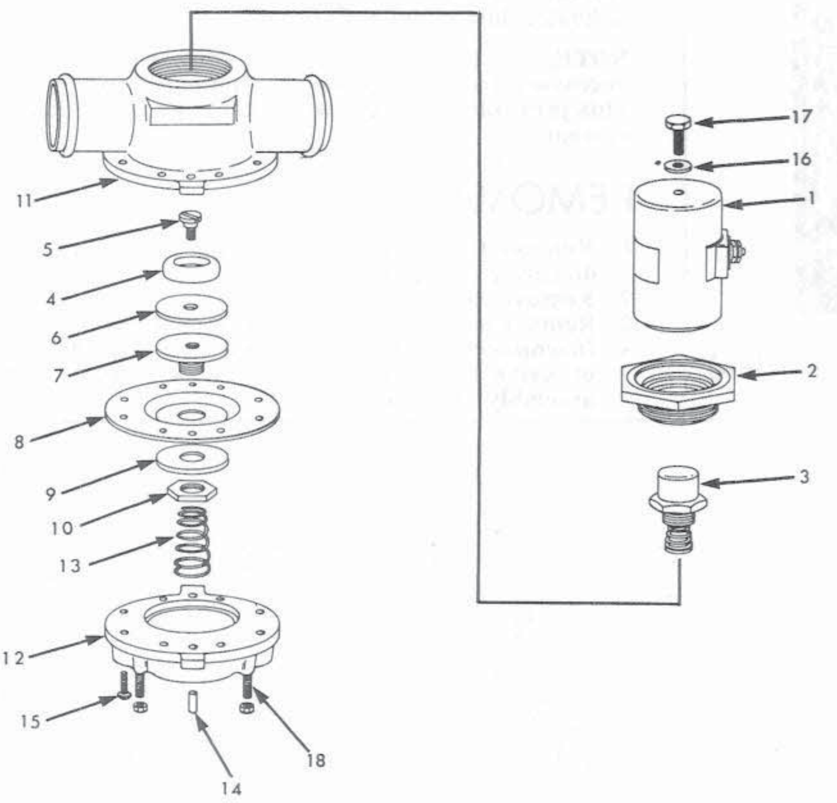

ENGINE COOLING & HEATING SYSTEM
MC-7
RADIATOR L.H.
HOSE 1 3/4 I.D.
HOSE 1 3/4 I.D.
RADIATOR OUTLET L.H. BOTTOM
HOSE 1 3/4 I.D. (WIRE WOUND FLEX)
HOSE 1 3/4 I.D.
DRAIN COCK
WATER PUMP HOUSING
C
HOSE 2 3/4 I.D.
RADIATOR INLET L.H. (TOP)
HOSE 2 1/4 I.D.
THERMOSTAT HOUSING
T
HOSE 1 3/4 I.D.
HOSE 1 3/4 I.D.
SURGE TANK
HOSE 2 I.D. BULGE
HOSE 3/4 I.D.
HOSE 2 1/2 I.D.
SIGHT GAGE LINE
HOSE 2 I.D. BULGE
HOSE 1 3/4 I.D.
HOSE 1 3/4 I.D.
HOSE 2 1/4 I.D.
HOSE 1 3/4 I.D.
SURGE TANK OVERFLOW
THERMOSTAT HOUSING
T
HOSE 1 3/4 I.D. WIRE WOUND FLEX
4 LB. RADIATOR CAP
RADIATOR INLET R.H.
HOSE 1 3/4 I.D.
HOSE 1 3/4 I.D.
BREATHER LINE
HOSE 3/4 I.D.
HOSE 1 3/4 I.D.
RADIATOR OUTLET R.H.
RADIATOR R.H.
ENGINE OUTLET HOSE 1 1/8 I.D.
ELBOW 90° (16C-11-62)
GATE VALVE
HOSE 1 3/4 I.D.
C/H CORE FEED
AIR COMPR. INLET
SHUT-OFF COCK
AIR COMPR.
WATER FILTER INLET
AIR COMPR. OUTLET
WATER FILTER (OPTIONAL)
WATER FILTER OUTLET
SHUT-OFF COCK
GATE VALVE
MAIN HEATER WATER VALVE (16C-7-41)
HOSE 1 1/4 I.D.
DRAIN COCK
D/H SHUT-OFF VALVE
HOSE 3/4 I.D.
DRIVER'S HEATER FEED
HOSE 3/4 I.D.
DRIVER'S HEATER CORE
DRAIN COCK
DRIVER'S HEATER RETURN
HOSE 1 1/2 I.D.
C/H CORE
DRAIN COCK
HOSE 1 1/2 I.D.
C/H CORE RETURN

Figure 16 - 1: Coach Heating & Engine Cooling



1. Coil & Container Assy.
2. Ring Assy.
3. Valve Seat Assy.
4. Modulator - Flow
5. Screw
6. Disc
7. Retainer
8. Diaphragm
9. Washer
10. Lock Nut
11. Body Assy.
12. Bottom Plate

Figure 16 - 2: Main Heater Water Valve

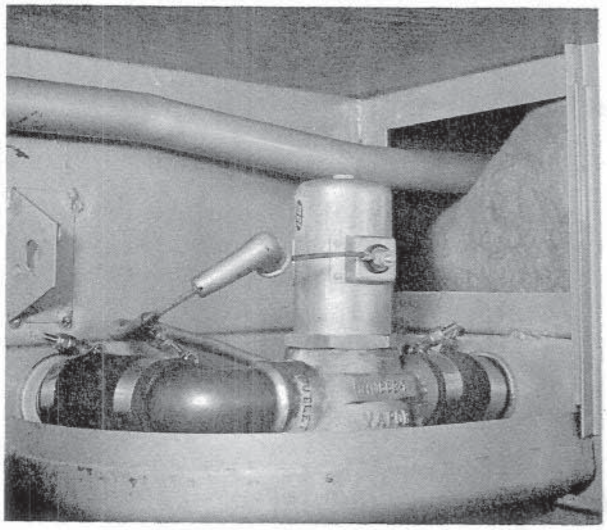


Fig. 16-3: Water Valve

Make certain the "Inlet" port is connected to the correct line.

REPAIR

Check operation of valve by energizing and de-energizing solenoid. The action of the valve can be observed through the outlet port.

If the solenoid operates satisfactorily, examine valve seat and valve disc for wear or dirt particles.

The valve may be disassembled by removing the screws attaching the upper body to the lower body.

Remove any rust or sludge particles from the water passages that may cause restriction.

Worn parts should be replaced.

Inspect and replace diaphragm if necessary.

DRIVER'S HEATER WATER VALVE

DESCRIPTION

The driver's heater control valve is manually

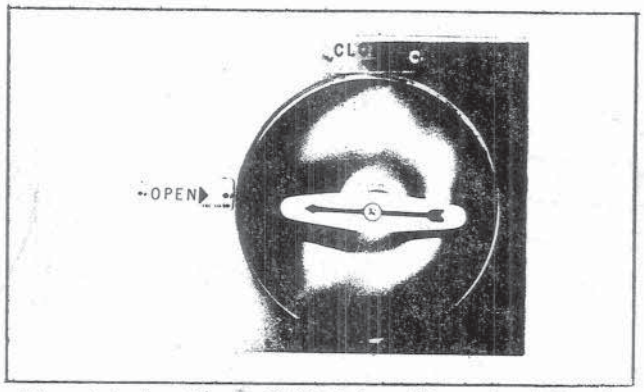


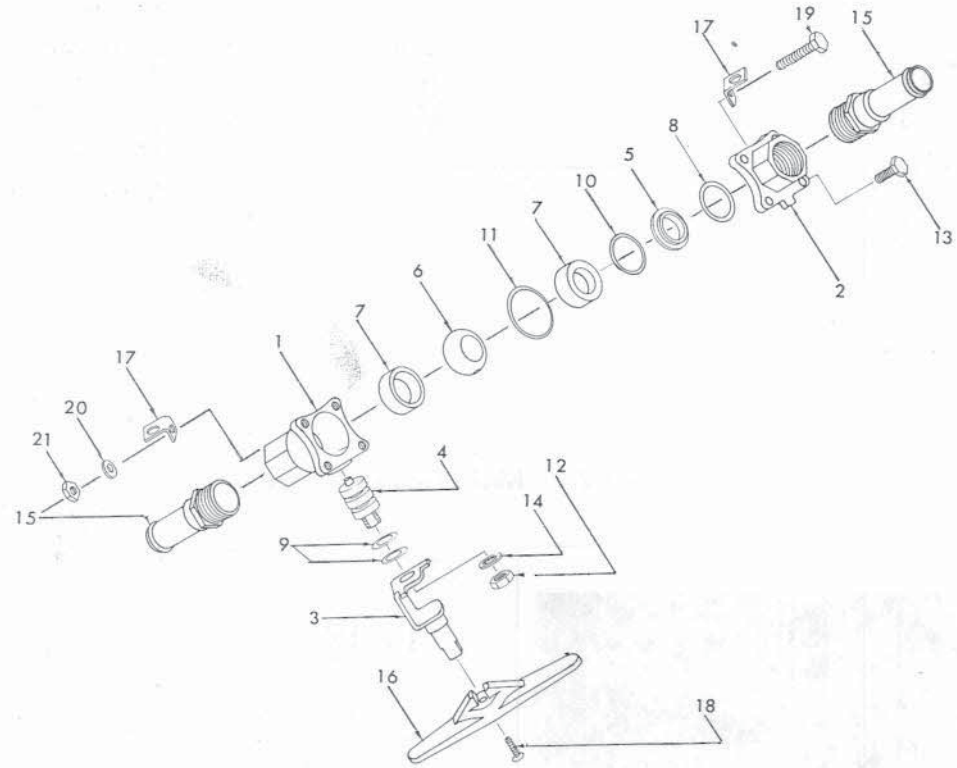
Fig. 16-4: Shut-Off Valve (Exterior View)

operated. It is located at the left-hand side of driver in heater duct panel at floor.

NOTE: Before removal of shut-off valve it is necessary to close valve in engine compartment. This prevents extensive water drainage from coolant system.

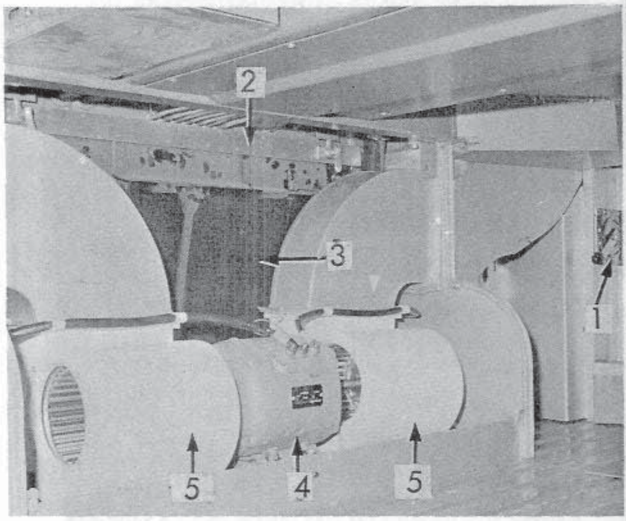
REMOVAL

1. Remove front junction box door panel and open defroster switch door.
2. Remove valve control knob.
3. Remove left-hand front heater duct panel.
4. Disconnect heater hose clamps at front and rear of valve assembly. Slide hoses away from valve assembly and remove valve.



1. Body
2. Cap
3. Stem S/A
4. Stem
5. Disc
6. Ball
7. Seat
8. Spring
9. "O" Ring - Stem Seal
10. "O" Ring - Seat Seal
11. "O" Ring - Joint Seal
12. Jam Nut
13. Screw
14. Lockwasher
15. Extension S/A
16. Handle
17. Angle
18. Screw
19. Screw
20. Lockwasher
21. Nut

Fig. 16-5: Driver's Heater Water Valve



1. Main Battery Switch
2. Filter Screen
3. Heater Core
4. Blower Motor
5. Central Heat Blower Fans

Figure 16 - 7: Central Heating Compartment

5. Remove upper hex nuts and screws mounting valve bracket to front junction box.
6. Remove Phillips head screws that mount bracket to floor.

DISASSEMBLY

1. Remove cotter pin from crank pin and slide yoke off.
2. Remove two hex nuts holding valve to mounting bracket.

REASSEMBLY

1. Mount new valve to bracket fastening with same screws and hex nuts removed during disassembly.
2. Install yoke to valve crank pin using new cotter pin. Valve assembly, complete with mounting bracket is now ready for installation.
3. Install screws, mounting bracket to front junction box.
4. Slide front and rear hoses over inlet and outlet of valve assembly and fasten clamps.
5. Install heater duct panel and control knob.

BLOWER MOTORS

All blower motors are 24-volt units of conventional design. Defective motors may be repaired according to standard procedures.

CAUTION—Do not use emery cloth or sandpaper for seating brushes or cleaning commutators. Motors brushes should be checked at regular intervals. If brush length is below 3/4" they must be replaced, otherwise serious damage may result to motor armature.

New brushes should be seated using a bedding stone.

SYSTEM CONTROLS

THERMOSTAT

A thermostat, or temperature sensing unit is installed in the R.H. air return duct. Changing temperature of air leaving coach interior causes thermostat to make or break electrical contact, energizing or de-energizing the water valve through a relay, controlling the flow of water through the heater core.

Wiring connections to the heating system thermostat are shown in the wiring diagram included in Section 7 (Electrical) of this manual.

TEMPERATURE

The temperature control is a rheostat unit which increases the resistance in the thermostat sensing element, causing cycling at higher or lower temperatures (68° - 78°).

This unit is installed at the driver's switch panel and provides a means of selecting a temperature range which is then automatically maintained by the action of the thermostat and water valves.

A/C & HEATER SWITCH

The A/C-Heating switch is fed from blower cut-in relay when generator is charging.

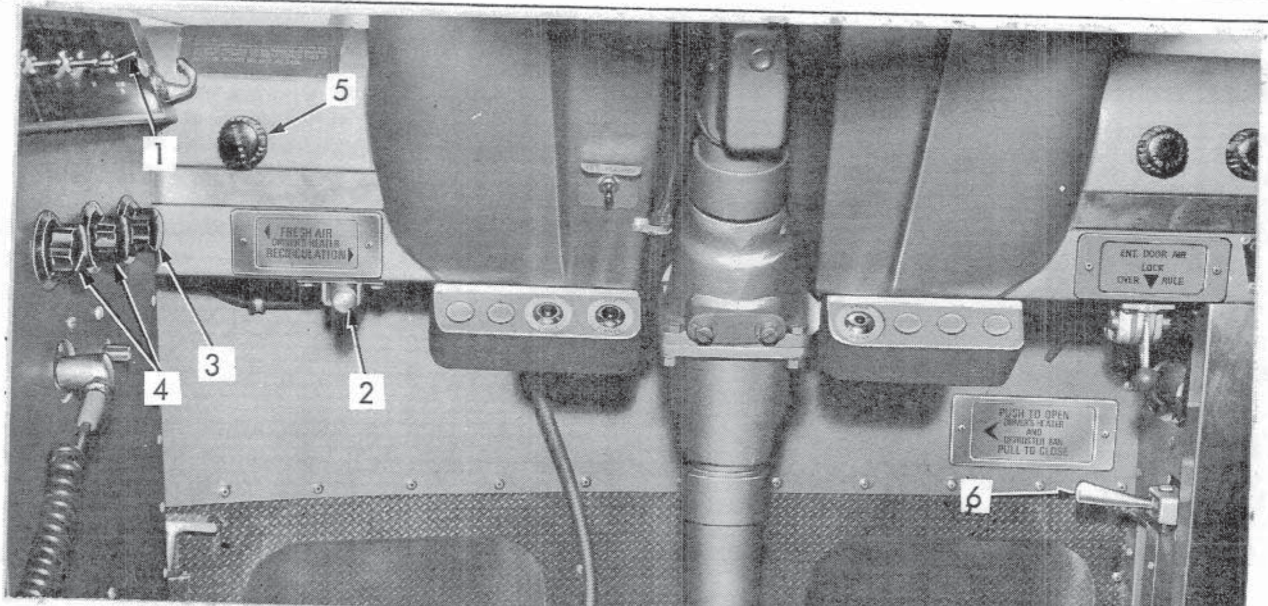
The selector switch in heat position "A" operates the central heating coach blower at low speed; in A/C position "B", it operates the following:

1) Coach blower operates at high speed
2) Condenser motor is energized.
3) Compressor unloading solenoid and scavenge solenoid are energized.
4) Condenser blower operates.

AIR CONDITIONING

The Motor Coach - Carrier air conditioning system is designed to provide a comfortable, healthful atmosphere within the coach. A schematic diagram of the air-conditioning system is illustrated in Figure 16-10.

A mixture of cooled, filtered, de-humidified fresh and recirculated air is supplied through wall ducts located below the side windows. The combination of outside and recirculated air is continually filtered, resulting in a clean fresh atmosphere.



1. A/C Heating Switch
2. Driver's Heater Air Control
3. Dash Light Switch
4. Driver's Heater Rheostat
5. Windshield Washer Control
6. Driver's Heater & Defrosfer Selector Lever

Figure 16 - 8: Temperature Control Switches

The air is drawn from the coach interior through center aisle ducts. It is filtered, cooled and dehumidified by evaporator coil, then passed through a temperature - controlled heat core. Two blower fans send the air conditioned air up into the wall ducts.

The system is designed to provide seven tons of refrigeration or 84,000 B.T.U. per hour heat removal.

A/C CYCLE

Refrigeration may be defined as "the transfer of heat from a place where it is not wanted to a place where it is unobjectionable". The major components required for a closed circuit refrigeration system are the compressor, evaporator, condenser, receiver tank and a liquid metering or expansion valve.

The air conditioning system in Challenger coaches is the "closed" type system using **"FREON 12"**.

- The refrigerant flows to the compressor, is compressed to high pressure and reaches a temperature higher than the surrounding air. It is passed through the air-cooled fins and tubes of the condenser coil causing the hot, high pressure gas to be condensed into a liquid form.
- The liquid refrigerant flows to the receiver tank, then through a filter-dryer where all moisture, acids, and dirt are removed. It is passed through a moisture indicator which indicates if any moisture is present in the system.
- By its own pressure, the liquid refrigerant flows through a thermostatic-controlled expansion valve where reduced pressure causes it to become a low temperature, low pressure liquid.
- The cold low pressure refrigerant passes through the evaporator coil, absorbs heat from the air passing over the fins and tubes, and changes into gas. In this form, the refrigerant is drawn into the compressor to repeat the air conditioning cycle.

The success of the air-conditioning system depends on retaining the conditioned air within the coach. All windows and intake vents should be closed. An opening approximately eight inches square

Temp. sensing unit location

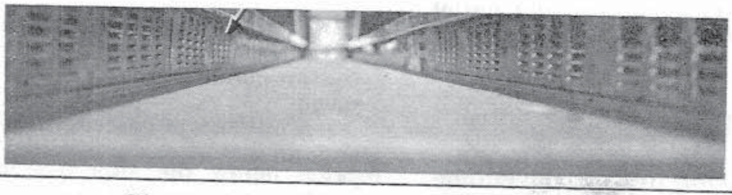


Figure 16 - 9: Center Aisle Ducts

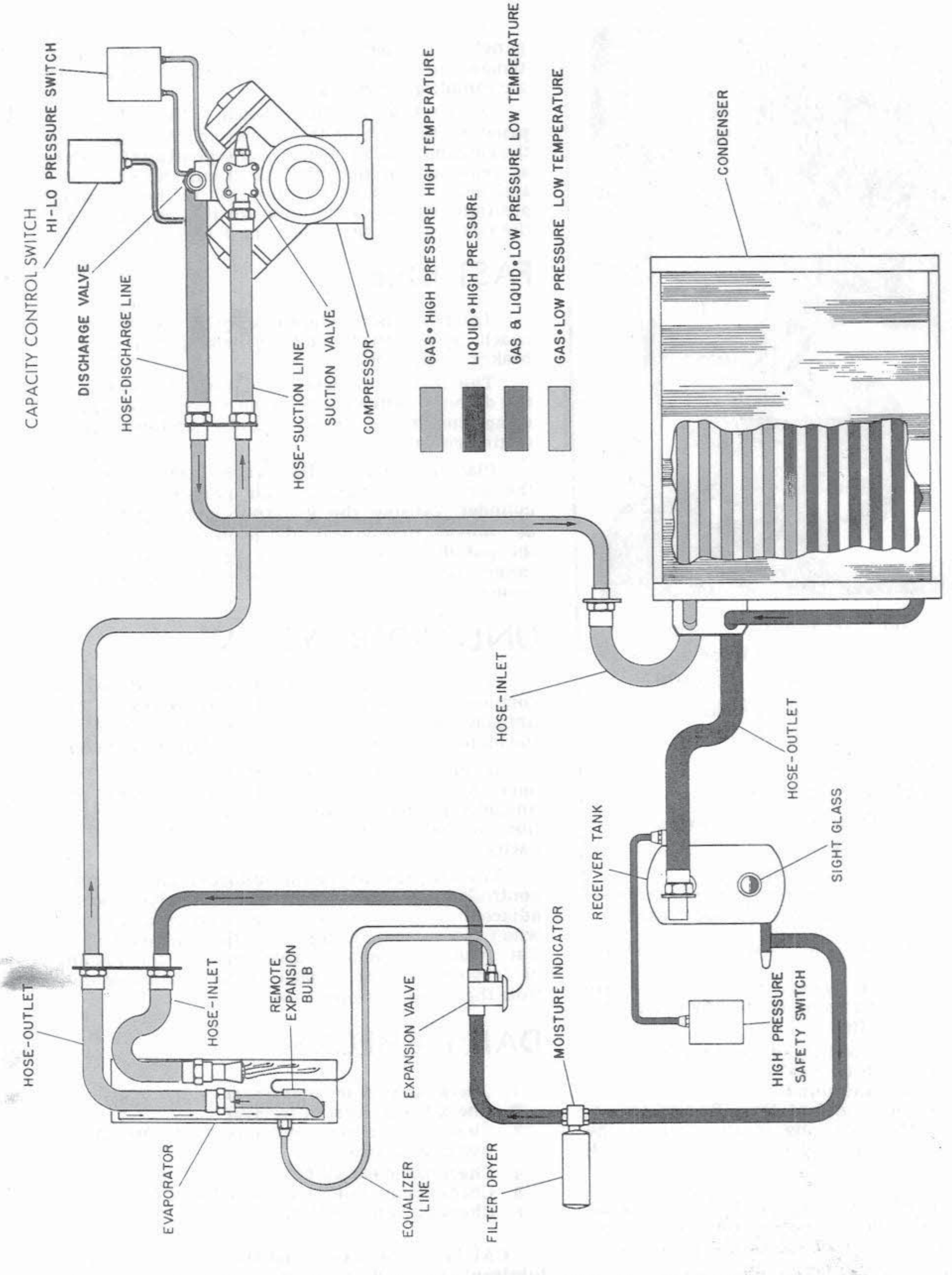
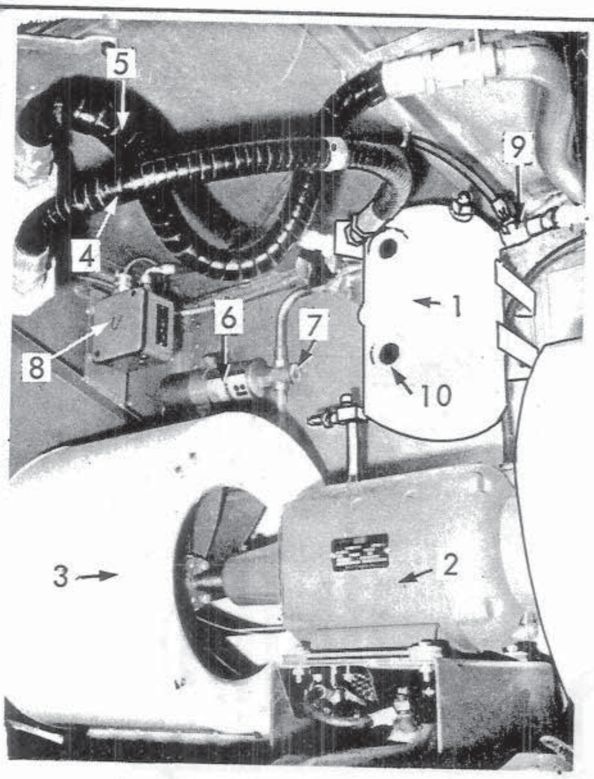

CAPACITY CONTROL SWITCH
HI-LO PRESSURE SWITCH
DISCHARGE VALVE
HOSE-DISCHARGE LINE
HOSE-SUCTION LINE
SUCTION VALVE
COMPRESSOR
▨ GAS• HIGH PRESSURE HIGH TEMPERATURE
■ LIQUID•HIGH PRESSURE
▨ GAS & LIQUID•LOW PRESSURE LOW TEMPERATURE
▨ GAS•LOW PRESSURE LOW TEMPERATURE
CONDENSER
HOSE-INLET
HOSE-OUTLET
RECEIVER TANK
SIGHT GLASS
HIGH PRESSURE SAFETY SWITCH
MOISTURE INDICATOR
FILTER DRYER
EXPANSION VALVE
EQUALIZER LINE
REMOTE EXPANSION BULB
HOSE-INLET
HOSE-OUTLET
EVAPORATOR

Figure 16 - 10: Air Conditioning System



1 - Liquid Receiver
2 - A/C Condenser Motor
3 - Condenser Fan & Housing
4 - A/C Condenser Outlet Hose
5 - A/C Condenser Intake Hose
6 - Filter Dryer
7 - Moisture Indicator
8 - High Pressure Safety Switch
9 - Purge Cock
10 - Freon Level Indicator

Fig. 16-11: Condenser Compartment

could easily neutralize the total capacity of the system.

Another cause of inadequate cooling is dirty coils or filter. Dirt acts as an insulation and is also a restriction to the air flow.

The refrigeration load is not constant and varies or is affected by outside temperatures, relative humidity, passenger load, the number of stops, etc. The compressor will load or unload depending on operating conditions. The following information on the operating conditions is only approximate and will vary with conditions:

Oil Level in Compressor	1/2 of sight glass
Freon Level in Receiver	1/2 of lower glass
Speed of Engine - Fast Idle	Approx. 900 r.p.m.

MANUAL SWITCH CONTROLS

1. Temperature Rheostat - Located on the switch panel to the left of the driver. It controls the air temperature in the coach during both heating and air conditioning cycles.

2. Air Con./Heating Switch - Located on the panel to the left of the driver. In "A/C" position, the air-conditioning system is energized and functions as required. In the "Off" position, the condenser and evaporator fans are shut off. In the "Heating" position, the evaporator fans are at "Low" speed and the air-conditioning compressor is unloaded.

FAST IDLE

The fast engine idle can only be used when the coach is stationary and the emergency parking brakes are applied.

The feature consists of a fast idle switch on the driver's switch panel, an air valve in the engine compartment and an air cylinder mounted on the engine governor.

Placing the fast idle switch "ON", energizes the air valve which lets air pressure to the air cylinder, causing the governor-operating lever to be moved to the fast idle position. To eliminate the possibility of engine damage, the accelerator cannot be operated when the fast idle switch is closed.

UNLOADER SYSTEM

An integral and internal mechanism allows the compressor to start with cylinders unloaded. The unloader mechanism is operated hydraulically by the oil pressure of the compressor lubricating system.

Without oil pressure, suction valves are held open by the unloader. Under oil pressure, the unloader mechanism allows suction valves to function normally and cylinders to operate at full capacity.

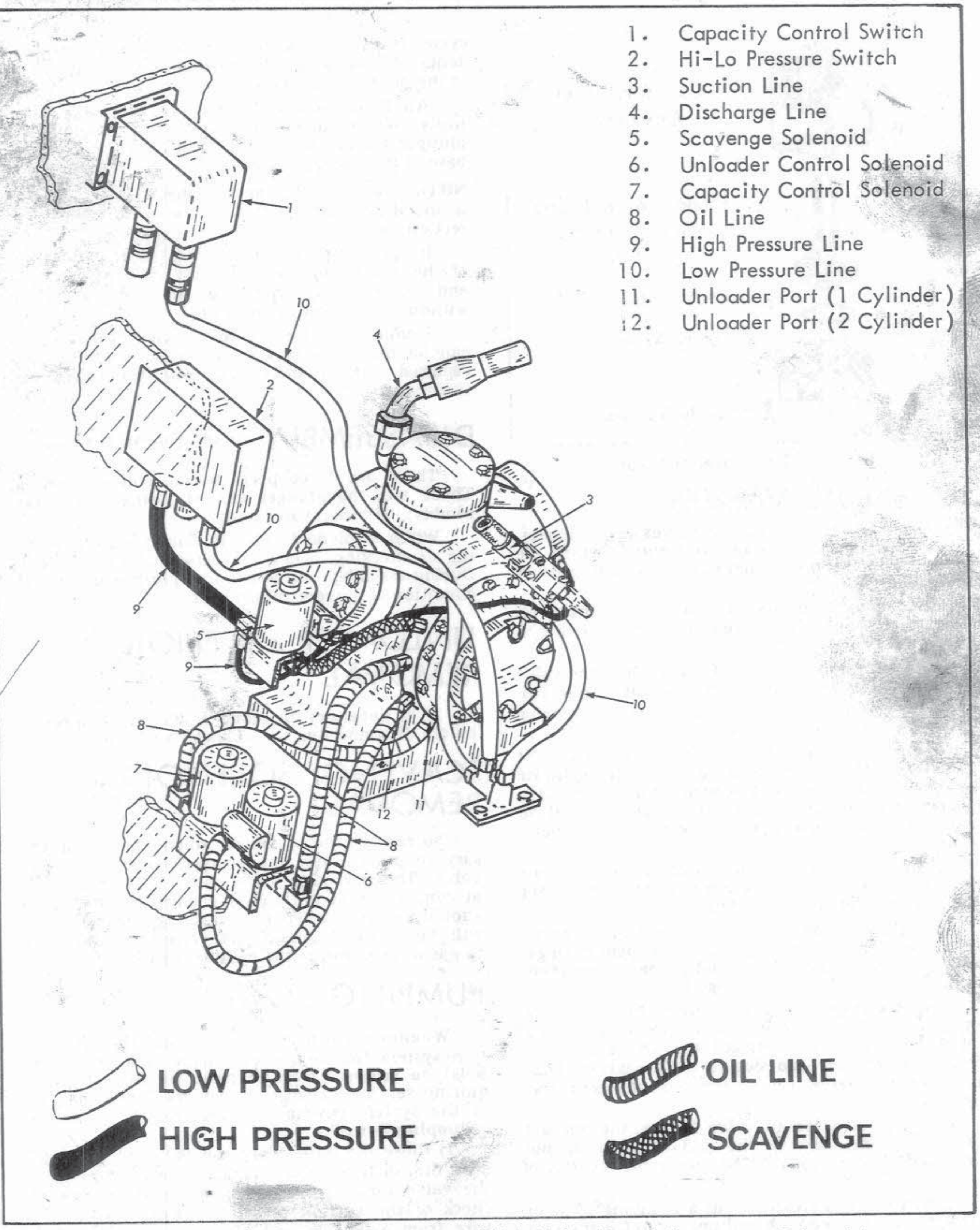
The oil pressure to the unloader mechanism is controlled by two electric solenoid valves located adjacent to the compressor. The compressor is loaded when the current is supplied to the solenoid valves. The loading solenoid valve controls the loading of 2 cylinders. The capacity control solenoid controls the loading of one cylinder.

DAILY CHECKS

1. Check oil level in compressor.
2. Check Freon level in receiver.
3. Check and clean condenser coil. **DO NOT** use caustic soap.
4. **Check and clean filter.**
5. **Check compressor and alternator belts.**
6. **Check moisture indicator.**

CAUTION: It is essential that only the correct lubricant be used, such as Capella DI or equivalent.

16A-2-13



1. Capacity Control Switch
2. Hi-Lo Pressure Switch
3. Suction Line
4. Discharge Line
5. Scavenge Solenoid
6. Unloader Control Solenoid
7. Capacity Control Solenoid
8. Oil Line
9. High Pressure Line
10. Low Pressure Line
11. Unloader Port (1 Cylinder)
12. Unloader Port (2 Cylinder)

LOW PRESSURE
HIGH PRESSURE
OIL LINE
SCAVENGE

Figure 16 - 12: A/C Compressor With Unloading & Scavenger Solenoid

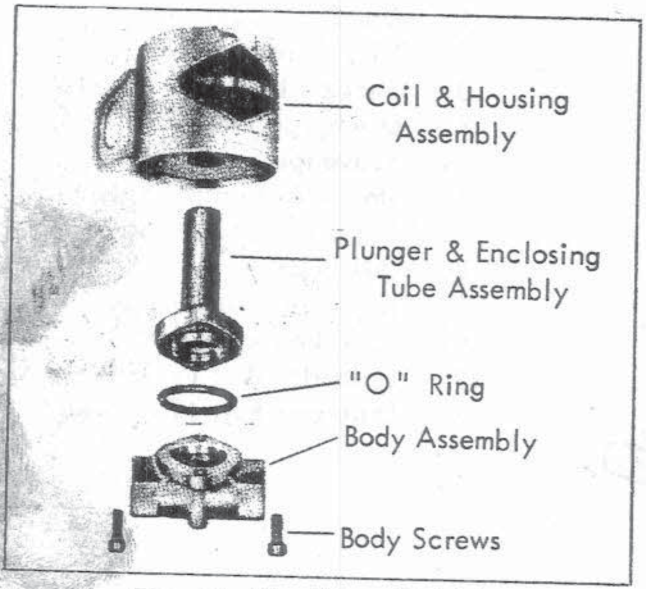


Fig. 16-13: Solenoid Valve

SOLENOID VALVES

There are three solenoid valves (1) Unloader, (1) Scavenge, and (1) Capacity Control, which are mounted to the frame channel at the R.H. side of the compressor.

Unloader Valve: Its function is to control oil flow to the unloader power elements of two cylinders of the A/C compressor.

a) When the valve is at "Current Off", the valve opens and the A/C compressor remains unloaded.

b) When the valve is at "Current On," the valve closes and the A/C compressor is loaded.

Capacity Control Valve: When the valve is at "Current Off," the valve opens and third cylinder of A/C compressor is unloaded. When the valve is at "Current On," the valve closes and third cylinder compressor is loaded and resumes operation.

Scavenge Valve: A scavenge valve prevents the possibility of oil migration from the compressor crankcase during the unloaded cycle.

When the compressor is in the "OFF" cycle or unloaded, any oil bypassing the piston rings and carried over into the cylinder head is returned to the crankcase by the scavenge line.

The scavenge system is operated by a normally open solenoid valve. When the compressor is turned on, the solenoid is energized and closes the line from the cylinder head side to the crankcase. This prevents bypassing of compressed gas into the crankcase.

In case of solenoid valve failure, the amount of gas passing through the .046 restrictor is not detrimental although it will decrease the capacity of the system.

When the compressor is in a pumping cycle or loaded, there is enough volume of refrigerant to return the oil to the crankcase during the normal cycle. During the pumping cycle there is less tendency for oil to migrate past the piston rings due to the normal compression pressure.

All Freon solenoid valves are normally open units. When current is applied to the coil, the plunger travels down and closes the port in the base of the cylinder valve.

NOTE: Care must be taken to insure that the valve is installed with the flow arrow in the proper direction.

If a problem is located in the mechanical portion of the valve, the coil assembly may be removed and moved away from the valve during repairs without disconnecting the wires.

Similarly, if the problem is electrical, the coil can be moved away from the valve assembly and repaired without interfering with the refrigerant fittings.

DISASSEMBLY (lower portion of valve)

There are three parts to the solenoid valve. These are: the plunger and enclosing tube assembly; "O" ring; valve body.

When a solenoid valve is dismantled for cleaning or checking, a new "O" ring must be installed. During assembly, check for free plunger travel and condition of plunger rubber seat.

UNLOADER SOLENOID REMOVAL

It is necessary to pump down the compressor before disconnecting the unloader solenoid.

SCAVENGE SOLENOID REMOVAL

To remove the scavenge solenoid, it is necessary to pump down the compressor and solenoid valve. The discharge valve must be front-seated at completion of the pumping down process. Care should be taken when disconnecting lines as there will be a small amount of refrigerant loss due to gas trapped within the cylinder heads.

PUMPING DOWN

Whenever it is necessary to "open" the refrigeration system for service or repairs, the refrigerant must be removed from that part of the system requiring service. Localizing refrigerant into one part of the system (usually the receiver) is known as "Pumping Down".

1) Close the outlet valve on the receiver, backseat the suction valve, install a gauge and turn the valve forward 1/4 turn, thus enabling visual check of the suction pressure. Install a jumper wire from a 24-volt power source to the loading solenoid terminal over the high switch.

2) Run the compressor until pressure reads 1-2 p.s.i. then remove jumper.

3) The pressure will probably rise. Install jumper wire again and lower the pressure until it remains at one or two p.s.i. Stop compressor.

4) Close the discharge valve at the compressor.

NOTE: During this operation care must be taken not to fill the receiver tank over the top sight glass. It may be necessary to vent the tank. Always allow refrigerant piping and units to warm up to the ambient air temperature before opening system or sweating will take place inside the lines.

ADDING REFRIGERANT

To add Freon to the system, use the suction service valve on the compressor. Backseat the valve and connect a charging line from the Freon cylinder to the valve loosely. Tighten connection at Freon cylinder and open tank end slightly to purge air from the charging line. Tighten the charging line connection at the compressor. Screw the stem of suction valve in approximately two turns. Start the compressor and run at fast idle. Add sufficient Freon to bring the level in lower sight glass in receiver tank to mid-point. Always charge the system with the cylinder upright and the valve on top to avoid drawing liquid out of the cylinder.

When charging an empty system, weigh the amount of Freon put into the system. This will eliminate any possibility of overfilling. A full charge should be approximately 21 pounds.

INACTIVE SEASON PREPARATION

The system should be pumped down and the refrigerant isolated in the high side of the system. Close both valves on the receiver. Close and tag both suction and discharge valves on the compressor.

Disconnect the air conditioning compressor belt drive. Remove wire tagged #68 from air conditioning and heating switch at the driver's area and securely tape. This will deactivate air conditioning electrical system.

ACTIVE SEASON PREPARATION

- Open all valves before proceeding with reactivation.
- Check for oil or Freon leaks at compressor crankshaft seal.
- Install the compressor drive belts. Run system for at least 10 minutes or longer to stabilize.
- Check oil and Freon levels. Change the filter dryer element if necessary as evidenced by the moisture indicator.

AIR IN SYSTEM

If air or non-condensible gases are present, they usually move toward the receiver. The discharge pressure will rise above the pressure corresponding to the condensing temperature. To check this the system must be allowed to stand idle for several hours to cool down to the temperature of the surrounding air. Check the temperature at the condenser and receiver. Check the pressure at the compressor discharge. This pressure should be within 3 p.s.i. of the saturation pressure corresponding with the surrounding temperature.

EVACUATING SYSTEM

1. Dump charge by opening the purge cock on the receiver tank. Close the cock.
2. Open both receiver valves by turning "out".
3. Place the two compressor valves, suction and discharge, in a neutral position by turning each one six turns "in" from the "out" position.
4. Remove the caps from the two 90° adapters on the suction and discharge valves and connect two hoses to the vacuum hose.
5. Start the vacuum pump. Open the large shut-off valve and close the small vacuum gauge valve.
6. The pressure will drop to approximately 29" vacuum fairly quickly. The dial gauge only gives a general idea on the absolute system pressure.

Open the smaller valve to read the Jas. P. Marsh vacuum gauge. It will be necessary to leave it open several minutes to get a true reading.

DO NOT leave it open except when checking the pressure otherwise the water in the gauge will boil off.

CAUTION: Before evacuating, make sure there is water in the gauge. If low, add distilled water.

A plugged dehydrator is indicated by differences in temperatures on either side of the dehydrator.

7. Normally, it will take about an hour for the pressure to come down to a point where the thermometer reads 32°F. A damp system will take longer. Evacuation must be taken down to at least 32°. Note that water in the gauge will freeze below 32°. Any readings below this will not be accurate.
8. Backseat the compressor valves by turning "out" all the way.
9. Shut down the vacuum pump.
10. Remove the hoses.
11. Reinstall the caps at the suction valve take-off points.

CHARGING SYSTEM

When a system has been opened or if there is

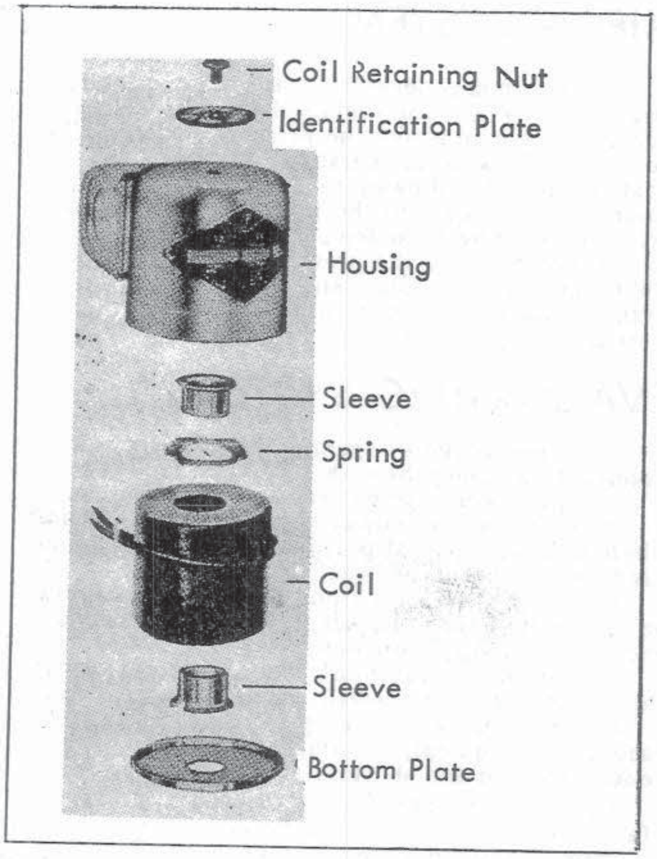


Fig. 16-14: Solenoid Coil

any question about the air or moisture in the system, **EVACUATE** the system. Charging of an evacuated system may be accomplished by forcing liquid Freon 12 directly into the receiver tank.

This may be accomplished by placing the refrigerant tank upside down on a scale (bathroom type) with the valving at the bottom (late model tanks have dual valves for vapor and liquid charging). This ensures that only liquid enters the reservoir.

1. Backseat the two compressor shut-off valves ("out").
2. Install the test gauges at the shut-off valves noting that the 400 p.s.i. gauge is connected to the discharge.
3. Turn in the two shut-off valves 3 to 4 turns.
4. Open the lower receiver valve by turning all the way "out".
5. Backseat the upper receiver valve by turning all the way "out".
6. Remove the cover cap from the service fitting in the top receiver valve.
7. Attach a charging hose to the Freon tank. Open the tank valve slightly permitting Freon to escape thus purging the hose of air.
8. Connect the charging hose to the service fitting.
9. Open the Freon tank valve.
10. Turn in the upper receiver valve several turns. The Freon will now enter the system.
11. The proper charge of Freon is 21 pounds. When the scale indicates this amount of charge, backseat the receiver valve and close the Freon tank valve.
12. Disconnect the charging hose. Replace the cover caps.
13. The system is now ready for operation.

LUBRICATION

Too much oil in the system is just as harmful as too little. To ensure proper lubrication, the level should be maintained within certain limits.

When operating at normal loads, the level at the glass in the compressor should be approximately 1/2 full. After standing, it may show 2/3 full. Some variation to these levels is permissible, particularly when operating.

After standing idle for any length of time, the compressor will normally pump crankcase oil into the system and approximately 20 minutes of running time may be required to bring it back to the crankcase.

After the unit has run at least one-half hour, the crankcase temperature should be warm to touch.

If cool, this indicates the expansion valve adjustment is passing too much liquid or there is excessive oil in the system. Oil level is always lower in a cool crankcase due to cooling evaporating refrigerant causing oil to foam and be carried out into the system.

ADDING OIL

1) Check supply of refrigerant in system. Lack of refrigerant will cause the glass to show insufficient oil.

2) Pump the system down and reduce compressor pressure to approximately 2 p.s.i. Stop the compressor.

3) Loosen the scavenge drain fitting (top fitting on pump end bearing head). When the pressure has bled off, remove the plug and pour in oil.

NOTE: DO NOT use ordinary crankcase oil. Use refrigeration oil from sealed containers only.

REMOVING OIL

To remove oil from the crankcase, pump down the compressor by closing the suction valve and reducing pressure to approximately 2 p.s.i.

Stop the compressor and loosen the oil drain plug **(DO NOT TAKE OUT).** When the excess oil has been removed, tighten the plug, open valves and start compressor.

COMPRESSOR

The air conditioning compressor is a Carrier Model 5F-30, 3-cylinder type, located at the right rear of the coach in the engine compartment. The

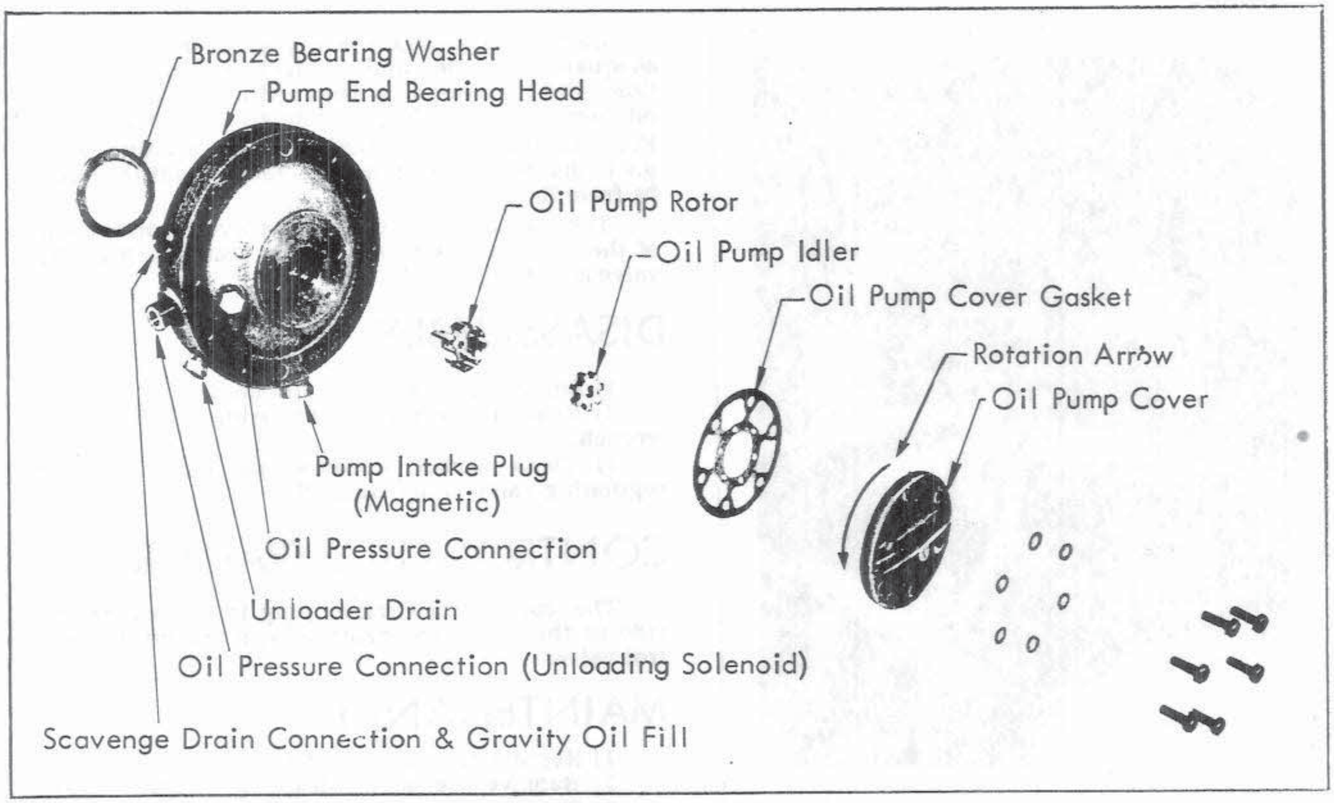

Bronze Bearing Washer
Pump End Bearing Head
Oil Pump Rotor
Oil Pump Idler
Oil Pump Cover Gasket
Rotation Arrow
Oil Pump Cover
Pump Intake Plug
(Magnetic)
Oil Pressure Connection
Unloader Drain
Oil Pressure Connection (Unloading Solenoid)
Scavenge Drain Connection & Gravity Oil Fill

Figure 16 - 15: Pump End Bearing

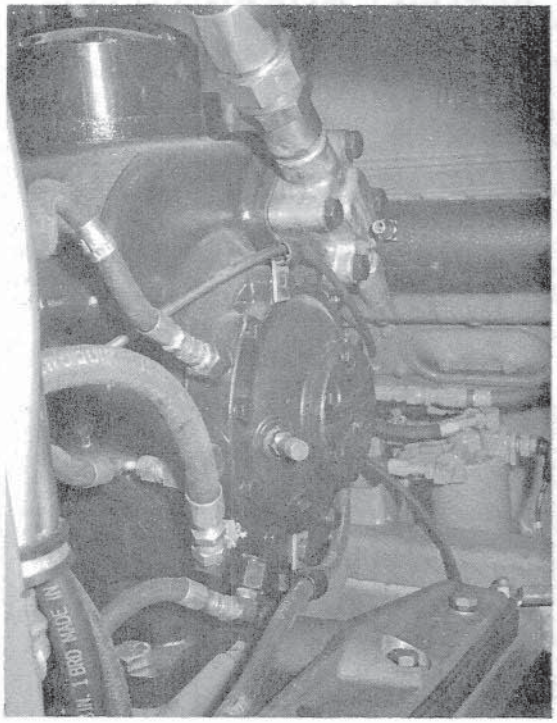


Fig. 16-16: A/C Compressor

compressor is driven from the engine crankshaft by means of two matched vee-belts, which are kept in correct tension by an air cylinder tightener device.

The compressor requires no periodic attention except a daily check of oil level as indicated above.

REPAIR & OVERHAUL

Remove the bottom cover plate. The oil pump filter screen can now be removed from inside the crankcase. If the screen is corroded, broken, or clogged with dirt that is not easily removed, replace it with a new one. Otherwise it may be cleaned and replaced.

PUMP END BEARING

ASSEMBLY

Remove the bearing head bolts and pull the assembly away from the end of the crankshaft.

Clean off and inspect gasket surfaces for signs of damage. Grasp the tang of the oil pump rotor with a pair of pliers and check the rotor for end play. If there is end play, the steel oil pump bushing is not properly positioned. Turn the rotor. There should be a slight drag, but no binding. This check should be made with a film of oil on the parts.

REASSEMBLY

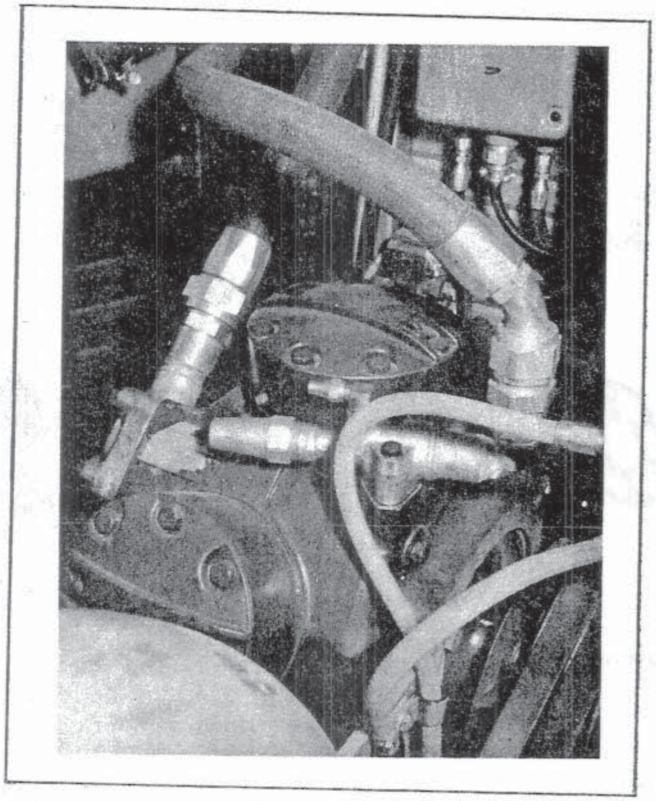


Fig. 16-17: A/C Compressor (Rear View)

When the oil pump becomes unserviceable, always replace the complete bearing head assembly to ensure proper alignment of the pump rotor, idler and bushing.

If repairs are made, install a new factory-made gasket between the pump end bearing head and the oil pump cover. **NEVER** install a home-made gasket. The thickness of the gasket is a critical factor in determining the oil pump clearance. Even factory gaskets vary and the pump must be checked. When replacing the bearing head, install a new gasket and line up the tang. on the oil pump shaft with the slot in the end of the crankshaft.

OIL PRESSURE REGULATOR

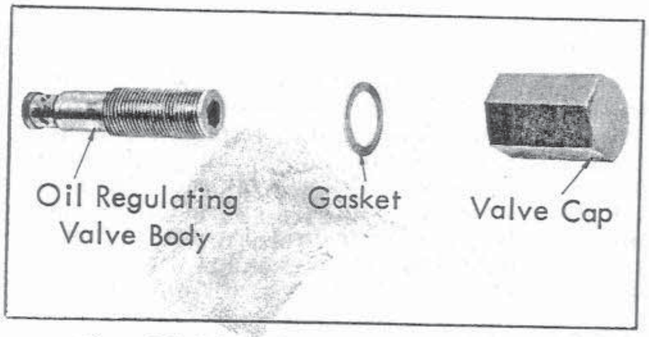


Fig. 16-18: Oil Regulating Valve

Correct oil pressure is important in maintaining adequate lubrication and satisfactory unloader operation. The compressor is designed to operate with the oil pressure 45 to 55 p.s.i. above suction pressure. For example, if the suction gauge reading is 30 p.s.i. the correct oil pressure gauge reading should be from 75 to 85 p.s.i.

The oil pressure regulator is located on the side of the crankcase adjacent to the seal housing. This valve is non-adjustable.

DISASSEMBLY

1) Remove the valve cap and gasket.
2) Remove the valve body using a 5/16" Allen wrench.
3) Clean gasket surfaces and make sure the regulating valve is not clogged.

CONTROL OIL STRAINER

The control oil strainer plug is located on the side of the pump end bearing head behind the control valve.

MAINTENANCE

1) Remove the Allen head lock screw.
2) Remove the orifice disc and strainer screen.
3) Check and clean the strainer.
4) Reassemble using a new disc.

OIL RETURN CHECK VALVE

These disc type oil return valves are on the underside of the partition between the suction manifold and crankcase with one on each side of the compressor. They allow oil to return from the suction manifold to the crankcase. Normally, they are open but will close when the crankcase pressure becomes higher than suction pressure.

The valves may be removed when the pump end bearing cover or the bottom cover plate is removed. Check that the check valve is not sticking.

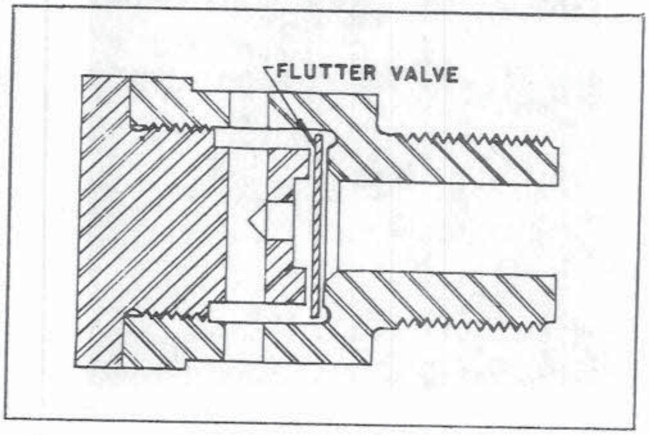


Fig. 16-19: Oil Return Check Valve

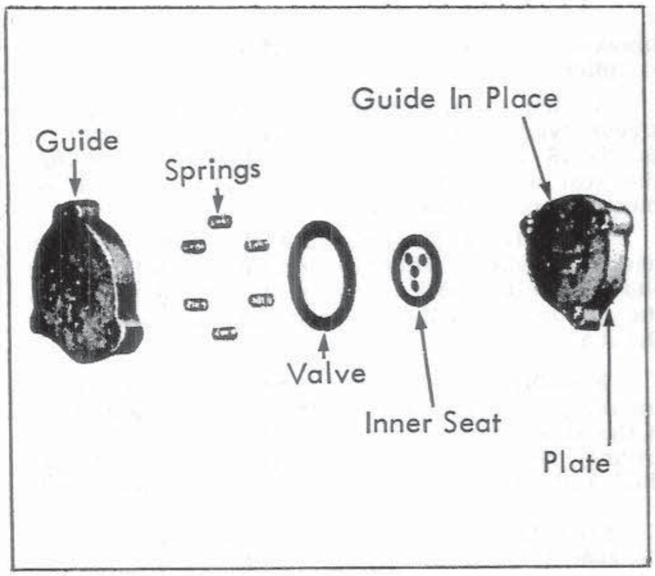


Fig. 16-20: Discharge Valve Assembly

CYLINDER HEADS

Remove the heads being careful not to damage the gasket sealing surface. Inspect the heads to be sure they are not cracked or warped and that the gasket sealing surfaces are satisfactory. Clean the old gasket material from the valve plate and reinstall the heads using new gaskets.

NOTE: When reassembling any part of the compressor, refer to Table 1 in the specifications section for correct torque values.

VALVE PLATE & DISCS

DISASSEMBLY

1) Loosen the three cap screws holding the inner discharge valve seat to the valve guide.
2) Loosen cap•screws holding valve guide to the valve plate.
3) Remove cap screws holding valve plate to the cylinder block and remove valve plate.
4) Remove valve guide from valve plate.

Inspect the suction and discharge valve discs to see that they are not cracked or worn beyond the limits as shown in the Specifications section, Table*2.

Valve plates are supplied with inner valve seats. Since the discharge valve sits on both the inner seat and valve plate, it is important that both surfaces have a comparable amount of wear and be in a similar condition for satisfactory discharge valve operation. A new valve disc should operate satisfactorily when used with old valve seats because the new disc will seat on surfaces that are of comparable wear. An old valve disc should either be replaced or turned over when used with new valve seats.

REASSEMBLY

Place only three valve springs in the alternate holes with the large coil in full contact with the bottom. Turn the crankshaft so pistons are below the tops of the cylinder sleeves.

Place the suction valve disc on the valve springs and press it down into the recess in the valve plate.

Slide the suction valve clips as shown in Figure 16-22. Locate the clips so they do not cover unloader springs. Bolt the valve plate to the cylinder block. Remove the suction valve clips.

Check the discharge valve springs for proper placement and properly seated. Place the discharge valve disc over the springs and fit the inner seat in place over the valve disc making sure the valve is properly seated.

Hand tighten the valve plate. Tighten all bolts and bend the tabs of the lockwashers and lock plates.

OIL SEAL

The seal is a rotary type, continuously immersed in oil. It is capable of adjusting automatically to wear and radial and axial movements of the shaft.

Remove the seal cover plate, seal and spring guide. Clean the seal cavity and crankshaft. Remove all burrs from the crankshaft to prevent damage to the neoprene bellows.

REASSEMBLY

When replacing a seal, the pump end bearing head assembly must be in place to ensure proper positioning of seal on the shaft. It is also possible

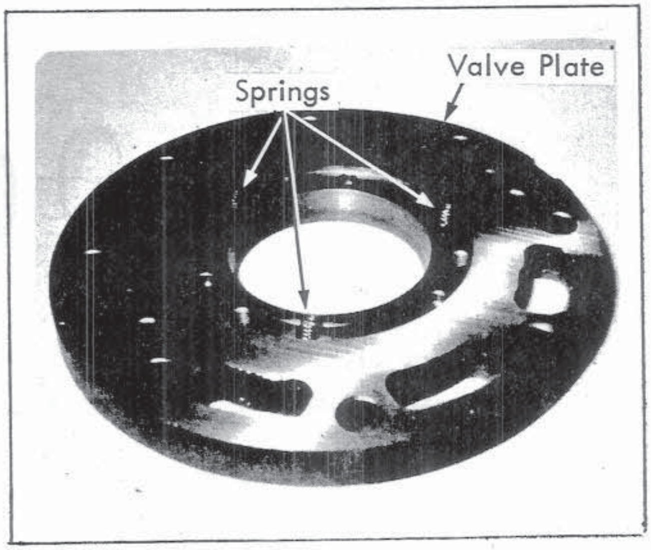


Fig. 16-21: Valve Plate Without Disc

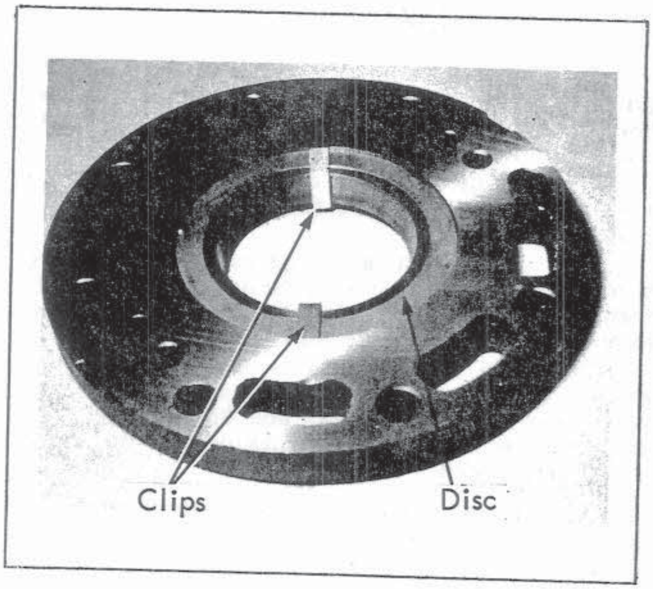


Fig. 16-22: Valve Plate With Disc

the seal end bearing washer will be pushed off the retaining dowel if the reassembly procedure is not followed.

The seal may leak slightly immediately after installation but a short period of operation will correct this condition.

One of the components of this shaft seal assembly is a carbon ring on which the seal bellows nose bears. This carbon ring is very easily broken and care should be used in handling it. Replacement of the carbon ring does not replace the seal. The only reason for replacing the carbon ring alone is breakage during installation. If the seal leaks, a complete new assembly should be installed.

A step by step installation procedure for the sleeve type rotary seal is shown in Figures 16 - 24, 16 - 25, 16 - 26, and 16 - 27. For a better view of how the seal is installed, the crankshaft is shown removed from the compressor.

FIGURE 16-24: Lubricate the shaft and the neoprene bellows where it comes in contact with the shaft. Slide the seal assembly, as it is shipped from the factory, until the neoprene just starts to grasp the shaft.

FIGURE 16-25: Holding the spring and sleeve assembly, pull forward on the seal nose assembly at the same time, turning it so that the lugs on the driving band are out of the slots in the retainer shell and rest on the surface of the retainer shell.

FIGURE 16-26: Using the seal cover plate, push the seal assembly into its proper location on the crankshaft. **DO NOT** bolt the cover plate on or use undue pressure as this will crush the seal. The spring guide should be tight against the side of the bearing surface as shown by the pencil. Remove the cover plate being careful not to damage the carbon seal washer. Grasp the seal nose assembly and turn it until the lugs on the driving band drop back into the slots in the retainer shell. Lubricate the carbon seal and seal seat.

FIGURE 16-27: Reinstall the seal cover plate, drawing the bolts down evenly to prevent damage to the carbon seal washer. This figure shows the lugs of the driving band properly positioned in the center of the slots of the seal retainer shell. This is the correct position during operation as it prevents the seal from being used as a thrust washer.

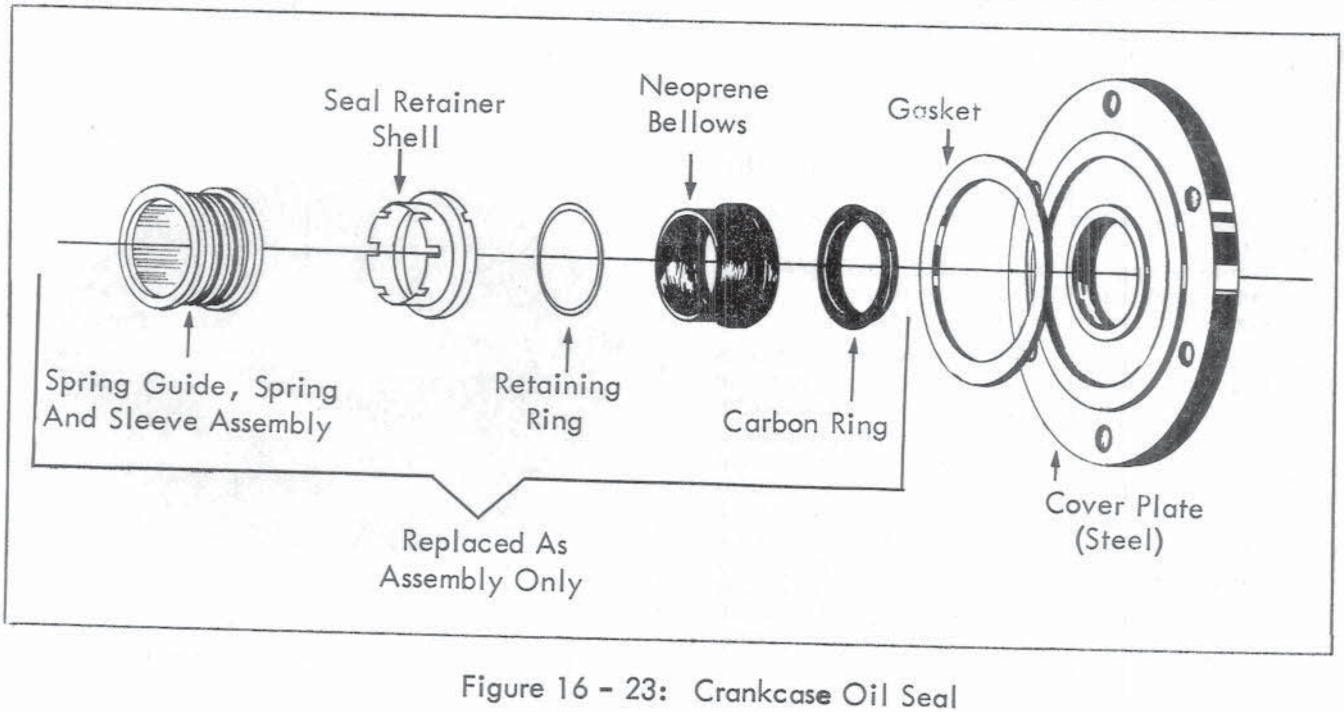


Figure 16 - 23: Crankcase Oil Seal

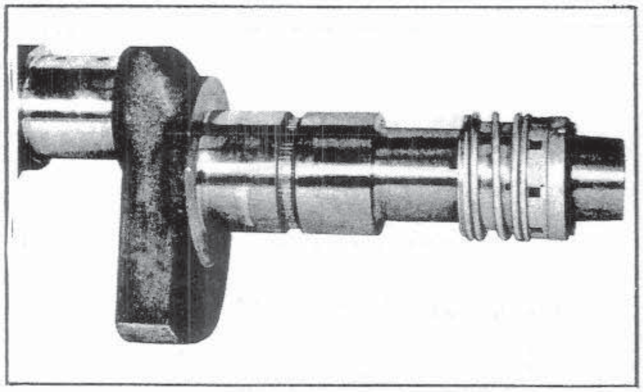


Figure 16 - 24

CYLINDER & UNLOADING SLEEVES

DISASSEMBLY: Turn the crankshaft until the piston is in mid-position. Insert a sleeve puller into the cylinder and push it down onto the top of the piston. Tighten the nut on the top of the sleeve puller to expand the puller in the sleeve. Turn the crankshaft by hand. This forces the sleeve up until it can be removed.

INSPECTION: Examine the bore of the sleeve for wear. Check the suction valve seat for scratches and wear. (See Wear Limit Table).

When new rings are installed in a used cylinder sleeve, it is necessary to break the hard glazed surface of the cylinder sleeve in order to reduce the wearing-in period of the new rings. Break the glaze by using #80 emery cloth with an oscilating (up and down rotating) motion, or re-hone lightly. Clean thoroughly after breaking glaze. Check unloader sleeves, pins and springs for wear and freedom of movement.

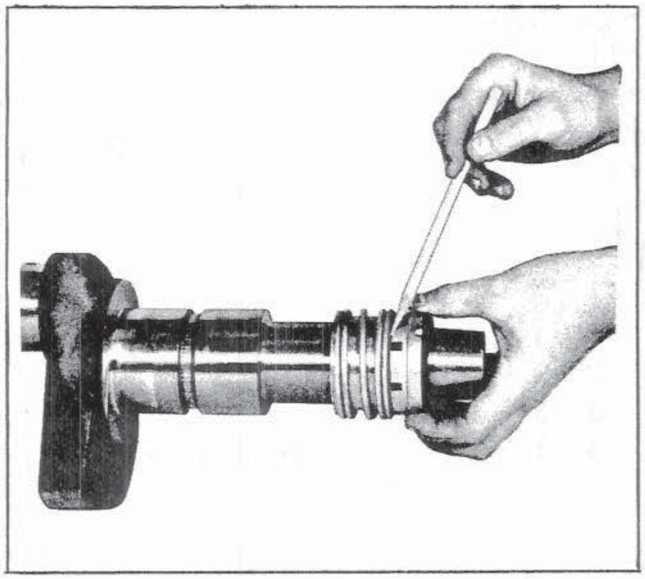


Figure 16 - 25

REASSEMBLY: When the cylinder sleeves are to be replaced, it is not necessary to remove the pistons and connecting rods. Rotate the crankshaft so the piston is at top center. Oil the piston rings and the bevelled surface at the lower edge of the cylinder sleeve. Stagger the ring gaps around the piston. With a turning motion, work the sleeve over the piston and rings. Compress and align each ring with the bevelled edge of the sleeve. Seat the sleeve in the suction manifold partition and the cylinder deck recess. Rotate the sleeve so that any two valve lifter pin holes lie equal distances from the longitudinal axis of the compressor. In this position the valve lifter pins line up with the suction valve springs and prevent.undue stress on the valve disc. Make sure that the valve lifter pins operate freely. Check operation of the unloader. This can be done by removing the solenoid control valve oil line from the pump end bearing head and applying Freon 12 pressure at the head. Approximately 35 p.s.i. should retract the unloader pins or springs.

CAUTION: Never operate the compressor with valve plates off unless the sleeves are fastened in place.

Cylinder sleeves can be held in place by cap screws and large washers. The cap screws are applied into the tapped holes normally used to hold the valve plate in place. Use washers large enough to extend well over the sleeve. Two washers or plates should be used for each sleeve.

When the cylinder sleeve or valve plate is replaced, the suction valve disc should also be replaced or turned over if the reverse side is unused.

CONNECTING RODS, BEARING INSERTS & PISTONS

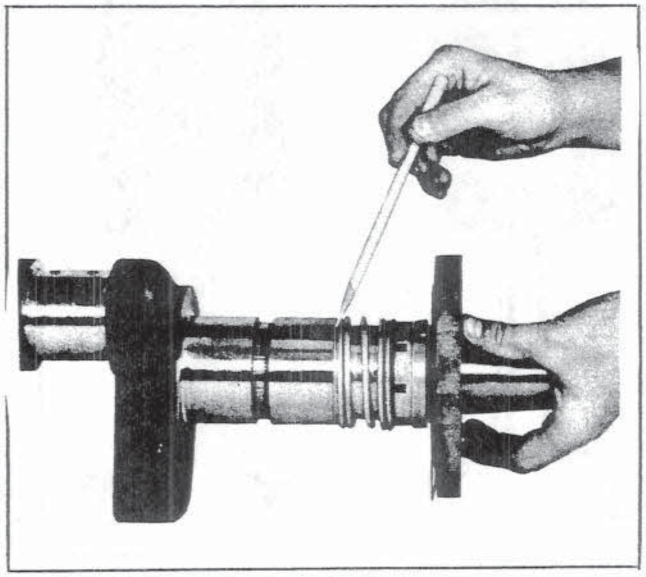


Figure 16 - 26

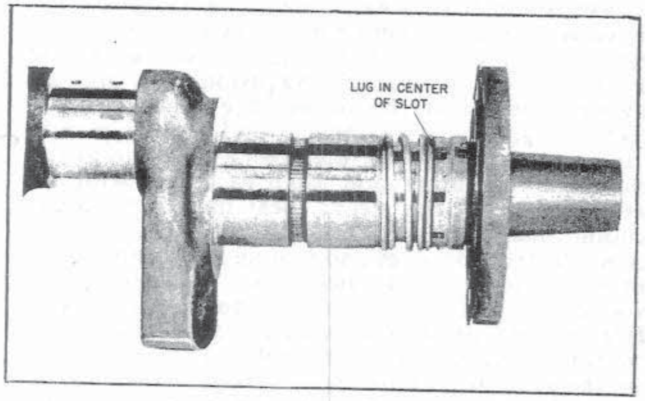


Figure 16 - 27

DISASSEMBLY

Remove the cylinder head, valve plate and bottom cover. Remove the connecting rod cap.

Label the caps and rods so that the caps can be put back on their respective rods and the rods reinstalled in the same places on the crankshaft.

Remove the cylinder sleeve, connecting rod and piston assembly together. Take care that the piston does not come through the top of the sleeve. The connecting rod will not pass through the sleeve and it is difficult to get the rings back into the cylinder without breaking them or damaging the suction valve seals.

INSPECTION

Check whether parts and crankshaft journals are worn beyond the limits listed in the Wear Limit Table.

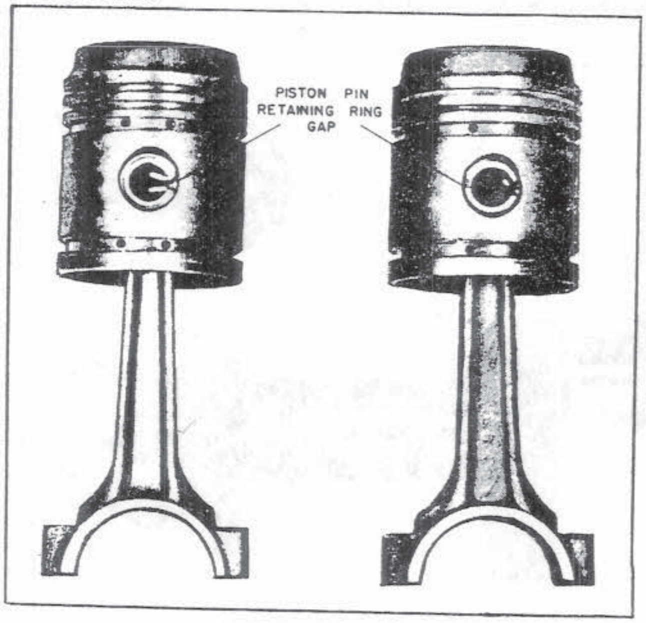


Fig. 16-28: Position of Retainer Clips

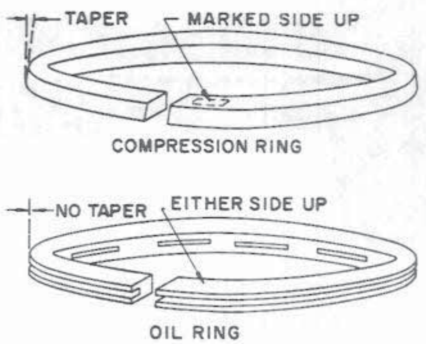


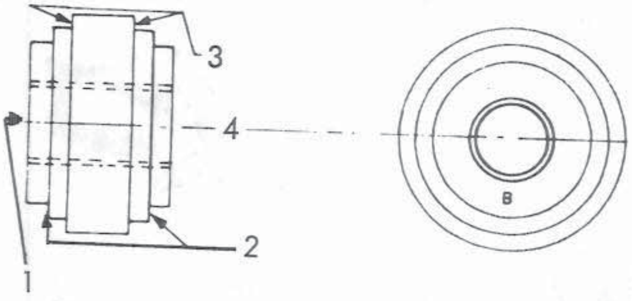
Fig. 16-29: Piston Rings

REASSEMBLY

Bearing inserts: If the bearing is damaged and crankshaft is not worn, replace only the inserts. **DO NOT** file the bearing caps.

Place the inserts in the connecting rod and cap so the toeing knobs on the inserts fit into the notches on the rod and cap. Lubricate the insert bearings and crankpins before installing the caps.

Piston pins are selectively fitted for a push fit. For a dry pin, 10 to 25 pounds pressure is required. The pins should be reassembled in the pistons from which they were removed.



1. This Side For Standard Bearing
2. Pump Shoulder
3. Seal Shoulder
4. This Side for Undersize Bearing (Stamped "B")

Fig. 16-30: Puller Shoulder

The piston pin lock rings should be placed with the gap on the side as per Figure 16 - 28 and be tight enough so that they cannot be rotated by finger pressure.

The rings taken in order from the head of the piston consist of two compression rings (plain), an oil ring (vented) and a second oil ring on the piston shirt. Insert each ring separately in the cylinder about 3/8" from the top and check the ring gap. It should be between .007 and .017"

Install the compression rings on the piston with the side marked "T" or "Top" toward the head of the piston. See Figure 16 - 29. Install the oil rings with either side up. (They have no taper). Stagger the rings gaps around the piston.

Check the rings for free action and measure the side clearance between the ring and the piston with a feeler gauge. It should be about .001.

ASSEMBLY

Install the sleeve, connecting rod and piston assembly at the same time, making sure the piston does not come out the top of the sleeve.

Turn the connecting rod and install the cap so the chamfered sides are against the radius of the crankpin. The small knobs on the rod and cap must be on the same side of the journal.

CRANKSHAFT

DISASSEMBLY

Remove the cylinder heads, valve plates, connecting rods, cylinder sleeves and pump end main bearing head. Remove the crankshaft through the pump end of the crankcase, tapping the seal end of the shaft with a mallet and wooden drift bar.

INSPECTION

Check whether crankshaft journals are worn within the limits given in specifications Table #2. Blow through the oil passages to be certain they are clear.

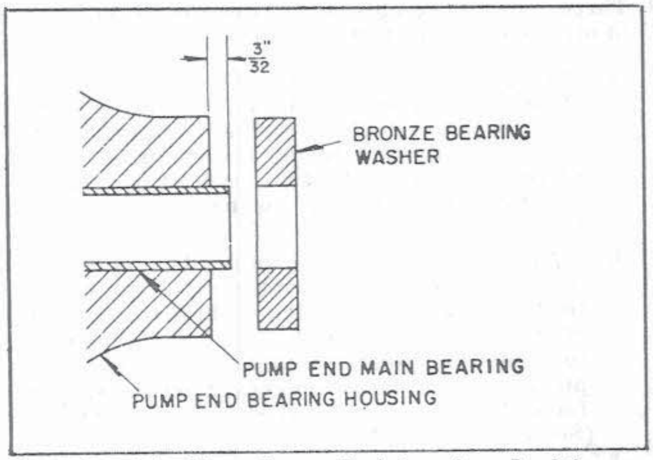


Fig. 16-31: Pump End Bearing Position

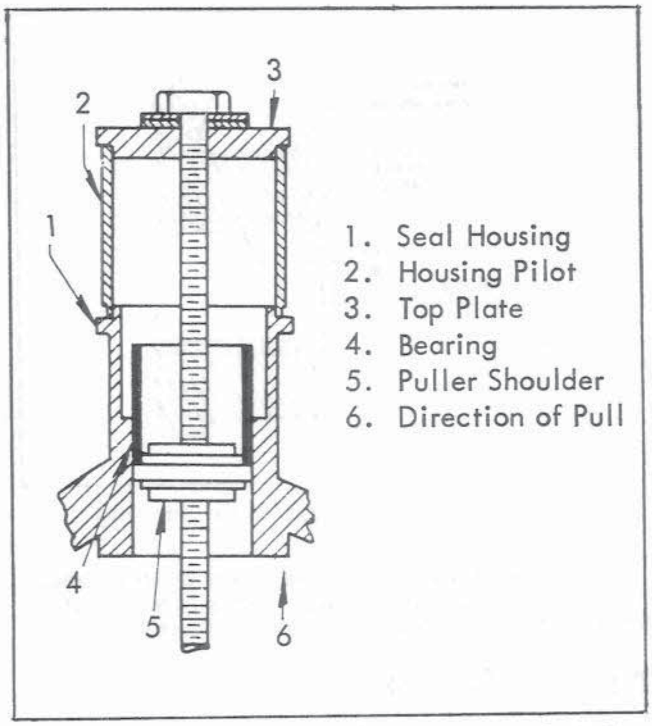


Figure 16 - 32: Removing Bearing With Puller

Connecting rod inserts and main bearings can be purchased for crankshafts reground .010" to .020" undersize. A worn crankshaft suitable for regrinding to .010" or .020" undersize can be exchanged for a factory reground crankshaft and bearings. Factory reground crankshafts are stamped on both ends with the letter "A" if .010" undersize or "B" if .020" undersize. If a crankshaft is reground locally, be sure to hold the throw dimensions to a maximum of 0.001 and to keep the radius at the ends of the journals at 1/16".

Specifications Table #2 gives the factory maximum and minimum diameters for journals. To get the maximum and minimum for an undersize shaft, subtract the amount of undersize (.010 or .020) from these values. For future identification, stamp the ground crankshafts with the letters "A" or "B" according to the undersize.

REASSEMBLY

When a crankshaft is reground, it is necessary to remove the plugs and clean the oil passages. Tighten the plugs before installing the crankshaft.

MAIN BEARING

A puller (#5F20-932) is available for replacing main bearings in the crankcase.

PUMP END MAIN BEARING

DISASSEMBLY

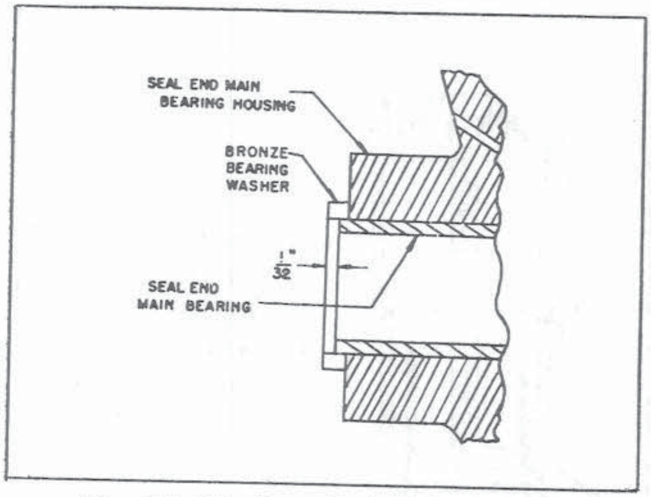


Fig. 16-33: Seal End Main Bearing

1) Remove the pump end main bearing head.
2) Chisel out the bearing, being careful not to damage the pump drive or bearing housing.

INSPECTION

Inspect the bearing housing and gasket surface. Remove any existing burrs.

REASSEMBLY

1) Lubricate the outside of the bearing with heavy grease. Line up the hole in the bearing with the oil port in the housing.

2) Using the puller shoulder (Figure 16-30) and a jackscrew or press, press the bearing into place. Let the bearing protrude beyond the housing 3/32" ± 1/64" so it will support the bronze bearing washer (Figure 16-31).

Install a new gasket along with the pump end bearing head. Be sure that the notch in the bronze bearing washer is properly positioned around the dowel pin.

SEAL END MAIN BEARING

DISASSEMBLY

Figure 16-32 illustrates the puller used to remove the seal end main bearing.

The puller shoulder is threaded and acts as a travelling nut.

Friction should keep the puller shoulder from turning with a bolt unless the threads are damaged. If they are damaged, use a 3/4-16 nut beween the thrust washer and bolt head. Hold the bolt head stationary and turn nut.

INSPECTION

If a burr or sharp edge is accidentally formed in the bearing housing, remove it and clean housing before replacing bearing.

REASSEMBLY

Lubricate the outside of the bearing with heavy grease. Position the bearing so chamfered edge enters bearing housing first and the oil holes in the bearing and housing are in line. Pull the bearing into housing with the puller until it is positioned as shown in Fig. 16-33.

Look through the oil pressure regulator opening in the crankcase to see that the oil passage to the bearing is not blocked. Check to see that the relief groove in the bearing is at the top. Blow out the oil groove in the bearing housing. The main bearings and connecting rod bearings are precision made and should NOT be reamed, bored, or shimmed.

UNLOADER POWER ELEMENT

Remove the cylinder head, valve plate, bottom cover, connecting rod, piston and cylinder sleeve. Remove two Allen head cap screws holding the unloader in position.

INSPECTION

Check the unloader fork height of the new unloader power element as per Figure 16-35. Measure from the base to the highest point on the fork arms. This ensures even contact with the unloader sleeve.

REASSEMBLY

Install the new power element using a new gasket between the element and the crankcase. If an unloader power element is disassembled, refer to Figure 16-34 for proper alignment of component parts.

LOADING & UNLOADING SYSTEM

1. Three-cylinder compressor unloading all cylinders in off cycle driven from coach engine.
    a. Integral oil pump driven from compressor crankshaft furnishes lubrication and oil pressure to load cylinders. Unloaders operated are two cylinders with spring loaded pistons operating a fork that lifts the suction valves off their seats causing the piston strokes to be ineffective or unloaded in the off cycle.
    b. Oil from the integral oil pump is supplied to unloader cylinders and returned to crankcase through the control solenoid in the unloaded or "off" condition. With the oil being returned to crankcase from the unloader cylinders no pressure can build up under cylinder and spring force holds suction valves off their seats. (See Fig. 38)
    c. Loading - When solenoids are energized, oil

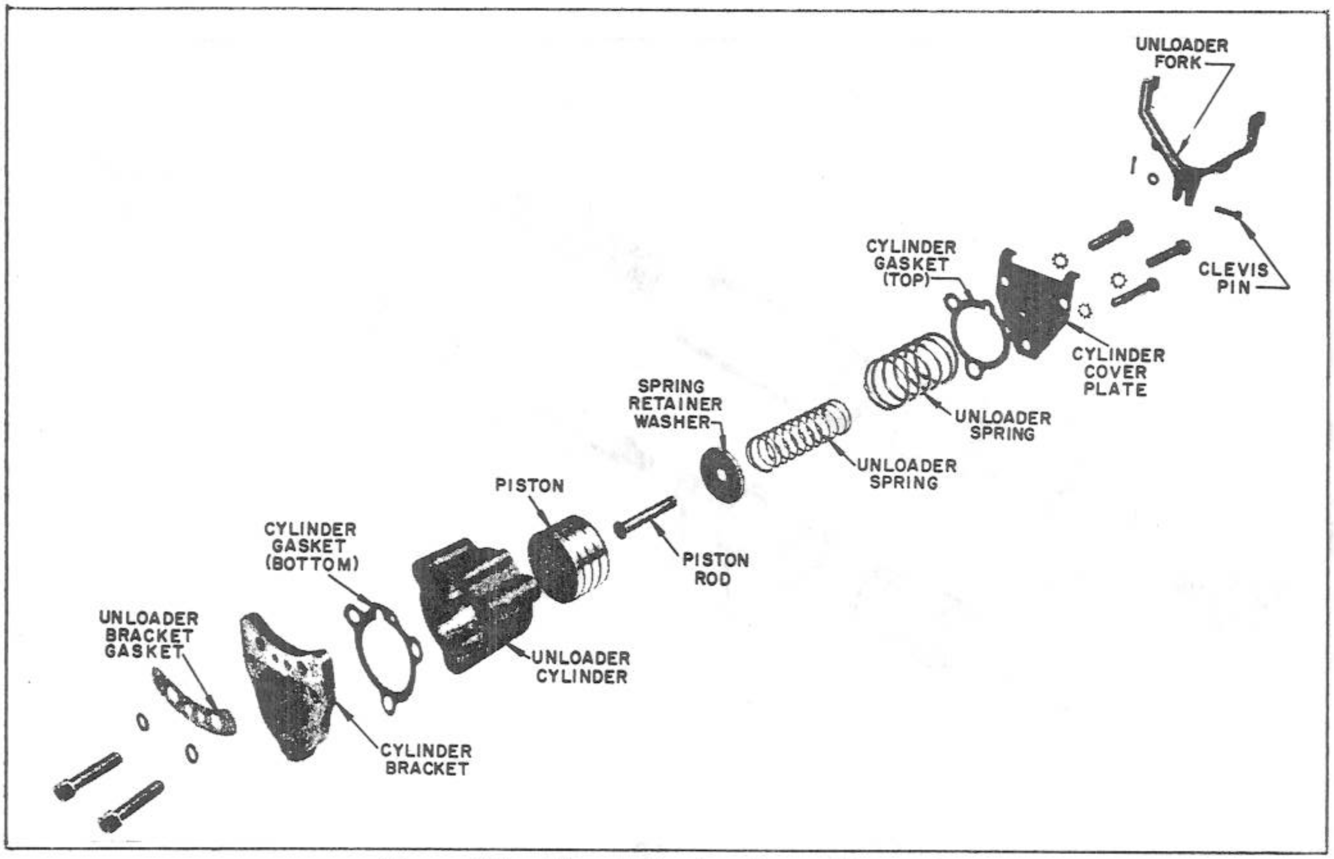

UNLOADER FORK
CLEVIS PIN
CYLINDER GASKET (TOP)
CYLINDER COVER PLATE
UNLOADER SPRING
SPRING RETAINER WASHER
UNLOADER SPRING
PISTON
PISTON ROD
CYLINDER GASKET (BOTTOM)
UNLOADER BRACKET GASKET
UNLOADER CYLINDER
CYLINDER BRACKET

Figure 16 - 34: Unloader Power Element

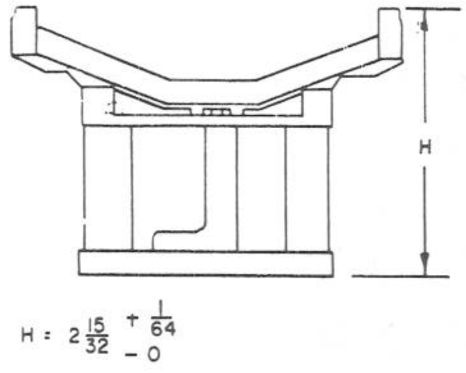
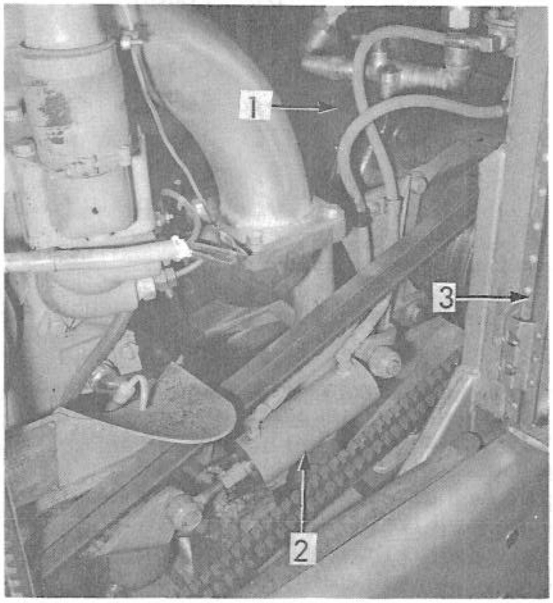

H
H : 2 15/32 + 1/64 - 0

Fig. 16-35: Unloader Fork Height

return from unloader cylinders is closed, therefore, oil pressure builds up under unloader pistons overcoming spring force, lowering the forks and allowing suction valves to seat and operate. (See Fig. 16-39).

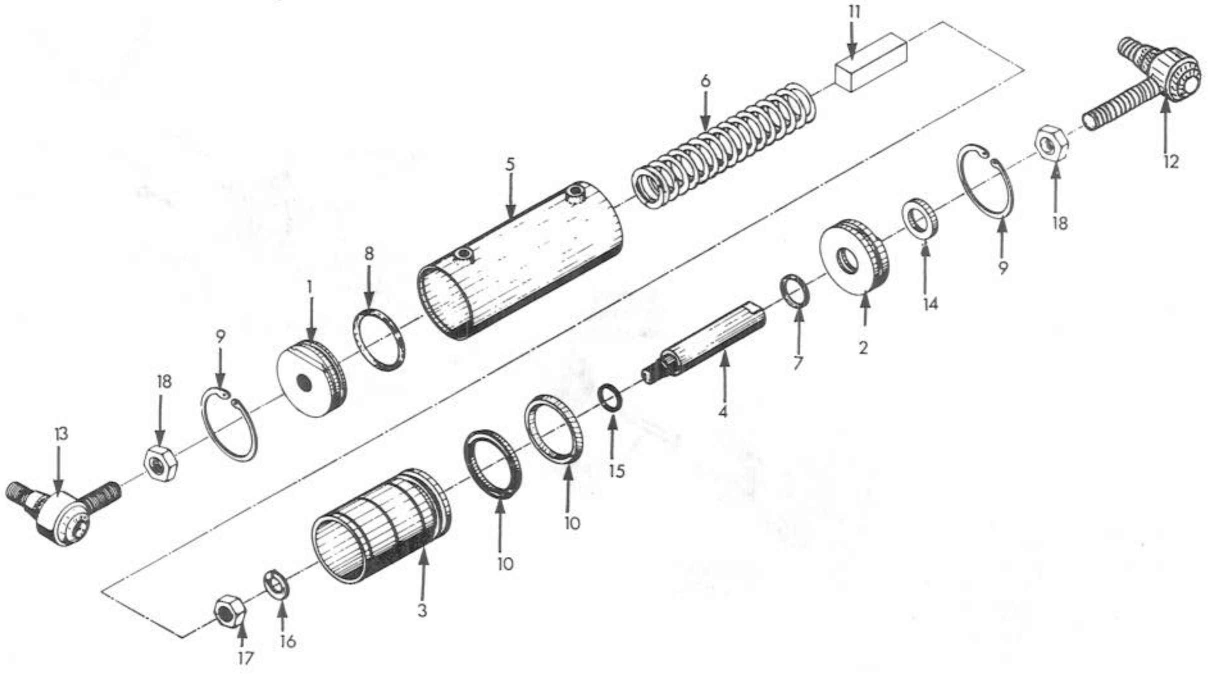
BELT TENSION CYLINDER

Proper belt tension is maintained by a double-



1. A/C Compressor
2. Belt Tension Cylinder
3. Rear R.H. Engine Door

Fig. 16-36: Belt Tension Cylinder On Engine



1. End Plate
2. End Bushing
3. Piston
4. Shaft
5. Cylinder Assy.
6. Spring
7. "O" Ring
8. "O" Ring
9. Snap Ring
10. Packing
11. Felt Oiler
12. Link End - Alternator End
13. Link End - Engine End
14. Oil Seal
15. "O" Ring
16. Lockwasher
17. Nut
18. Jam Nut

Fig. 16-37: Belt Tension Cylinder

Proper belt tension is maintained by a double-acting air cylinder anchored to a mounting bracket on the engine cradle and acting on the A/C compressor.

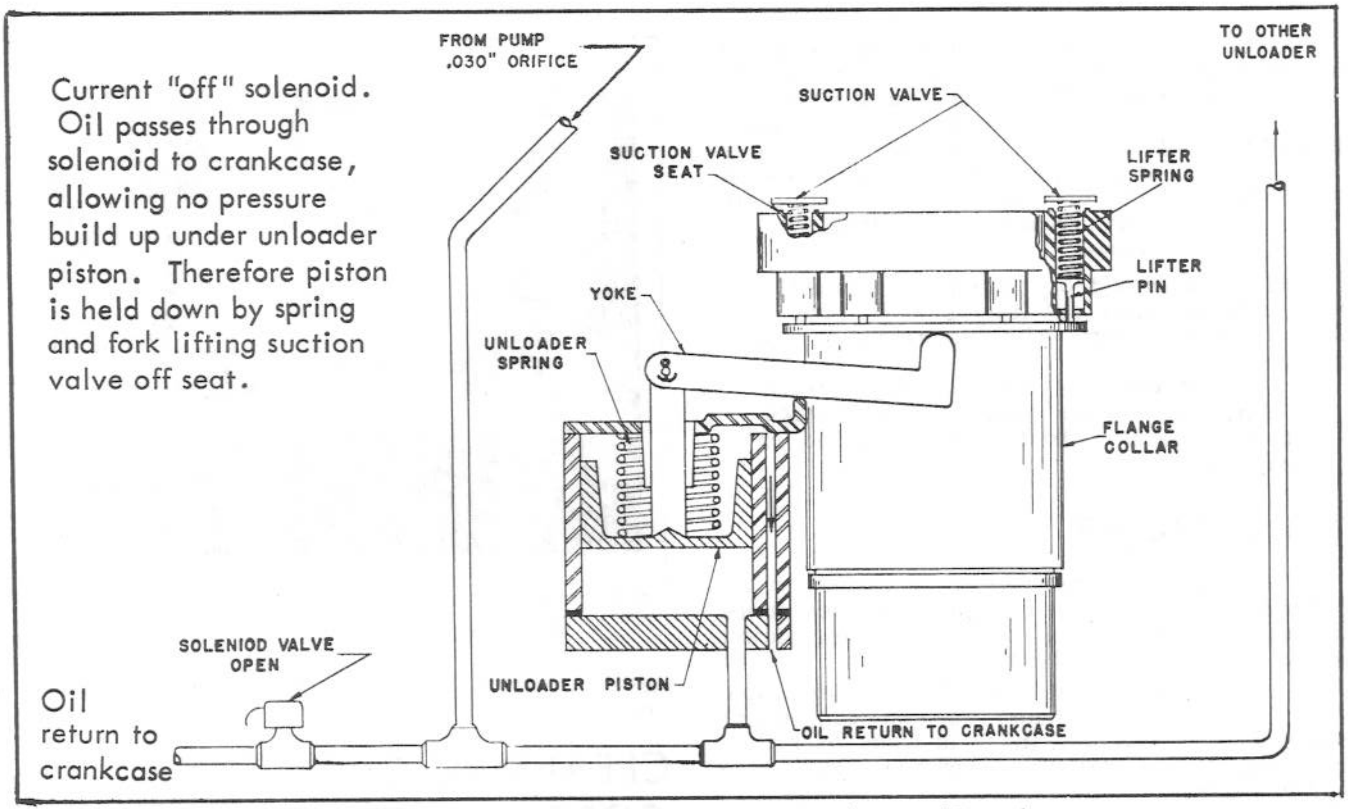
To facilitate air cylinder removal, remove A/C compressor drive belts first.

CAUTION: Exercise care during removal as spring tension will exist in the cylinder.

When installing air cylinder turn shaft to obtain 1" shaft protrusion on engine cradle anchor end. Tighten lock nut.

LUBRICATION

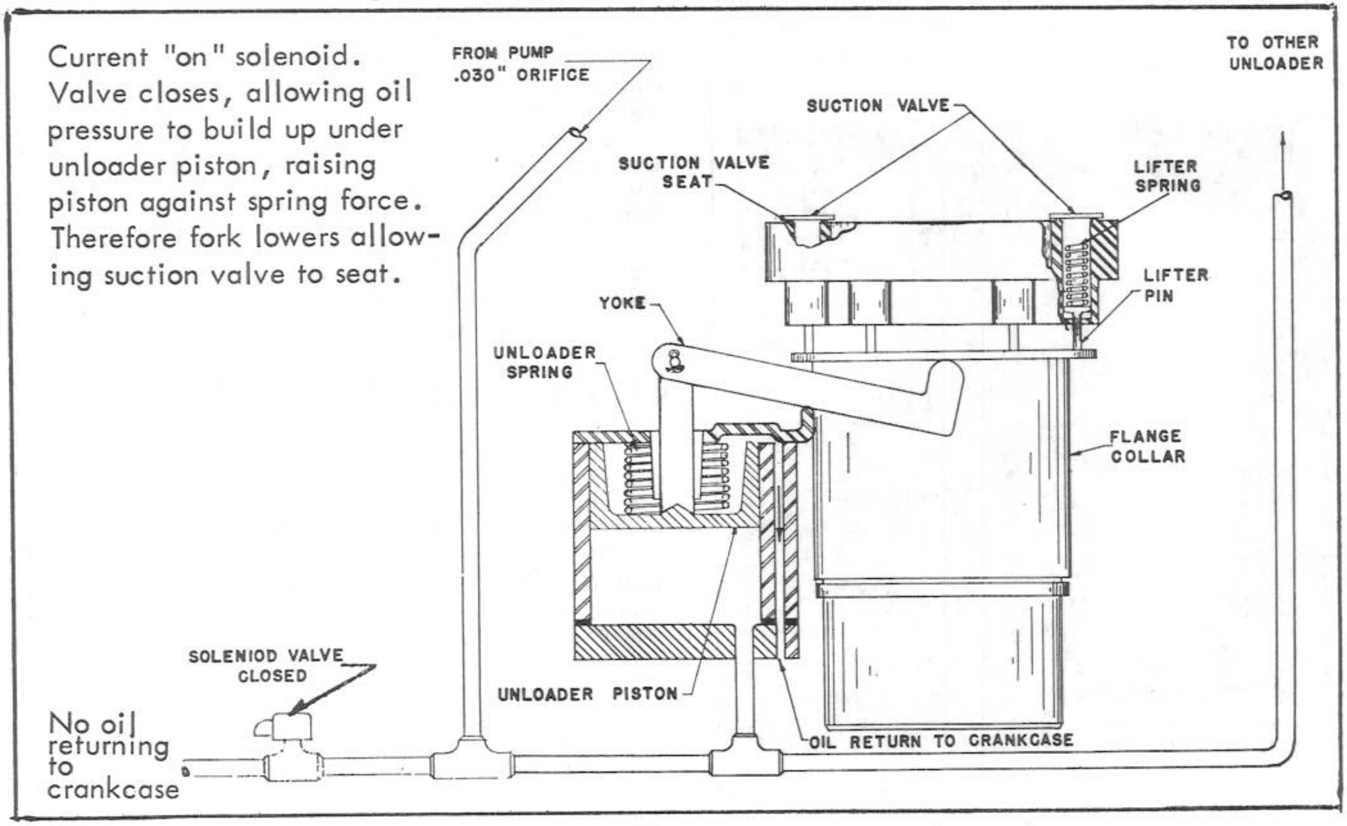
It is essential that only the correct lubricating oil be used. It should be to Carrier specification #PP36-1. Two such oils are Sun Oil Co. Sunisco #4G or Capella DI.



Current "off" solenoid. Oil passes through solenoid to crankcase, allowing no pressure build up under unloader piston. Therefore piston is held down by spring and fork lifting suction valve off seat.

FROM PUMP
.030" ORIFICE
TO OTHER UNLOADER
SUCTION VALVE
SUCTION VALVE SEAT
LIFTER SPRING
LIFTER PIN
YOKE
UNLOADER SPRING
FLANGE COLLAR
SOLENIOD VALVE OPEN
UNLOADER PISTON
OIL RETURN TO CRANKCASE
Oil return to crankcase

Figure 16 - 38: Suction Valve Discharge (Open)



Current "on" solenoid. Valve closes, allowing oil pressure to build up under unloader piston, raising piston against spring force. Therefore fork lowers allowing suction valve to seat.

FROM PUMP
.030" ORIFICE
TO OTHER UNLOADER
SUCTION VALVE
SUCTION VALVE SEAT
LIFTER SPRING
LIFTER PIN
YOKE
UNLOADER SPRING
FLANGE COLLAR
SOLENIOD VALVE CLOSED
UNLOADER PISTON
OIL RETURN TO CRANKCASE
No oil returning to crankcase

Figure 16 - 39: Suction Valve Discharge (Closed)

NOTE: In addition to the tools normally carried by the mechanic, the following tools are required:

1. #5F20-2061 Suction Valve Clips - used when valve plates are assembled on compressor.
2. #5F20-932 Bearing Puller Assembly - used to remove the seal end main bearing.
3. #5F20-572 Cylinder Sleeve Puller - used to remove cylinder sleeves from the compressor.

All parts should be thoroughly cleaned. Use stiff brush to wash dirt from grooves, holes, etc. Coat all moving parts with compressor oil before assembly.

CAUTION—Do not use carbon tetrachloride or similar solvent to clean parts. Use mineral spirits, white gasoline or naphtha.

CONDENSER

The condenser compartment is located on the left side of the coach, behind the front wheel housing and contains the coil, fan and housing blower motor, receiver tank and controls.

The condenser coil is mounted on the inner side of the compartment door. Since the condenser's purpose is to dissipate the heat from the hot refrigerant, it is important to keep the cooling coils and fins clean.

Dirt and grease clogging the coil causes a high head pressure and reduced efficiency to maintain efficiency. It is important to clean the condenser coil regularly, preferably once a day, using water under pressure directed at the inside surface of the core.

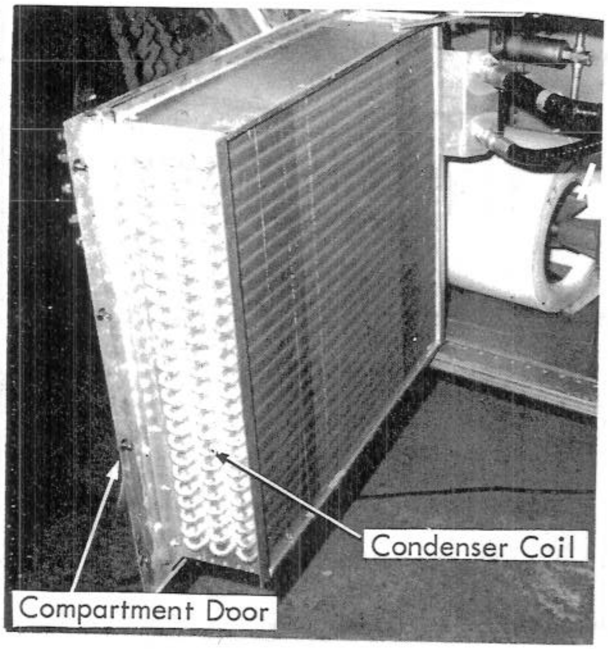


Fig. 16-40: Condenser Coil

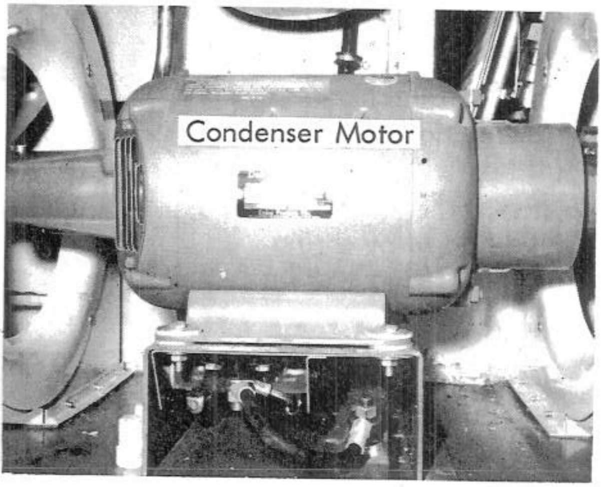


Fig. 16-41: Condenser Motor

CLEANING CONDENSER CORE

Check the external surface of the coil at regular intervals for dirt or any other foreign matter. A clogged coil will cause high discharge pressure and insufficient cooling.

Flush the condenser coil from inside out, using a water jet or water mixed with air pressure. Direct the pressure straight through the coil to prevent bending of fins. **DO NOT** use high pressure.

For an extremely dirty coil, use Kelite 28 as a cleansing agent. Mix with cold water and wash the coil. Rinse with cold water.

CAUTION: Do not use steam or harsh soaps.

CONDENSER FAN & MOTOR

The condenser fan is located in the condenser compartment. A 24-volt 2-h.p. electric motor operates the fan wheels, which are Sirocco type mounted to the motor shaft by taper-locked hubs.

When re-installing wheels, care must be taken that fan blades are curved opposite to rotation of motor. Wheels should be marked to their location before removing from shaft.

NOTE: It is very important when reassembling fan wheels to motor shaft that fan blades are curved opposite to rotation of motor shaft. Example: If motor shaft turns clockwise, the fan blades will be curved in a counter-clockwise direction.

DO NOT INSTALL fan wheels with blades curved in same direction as rotation of motor shaft as the

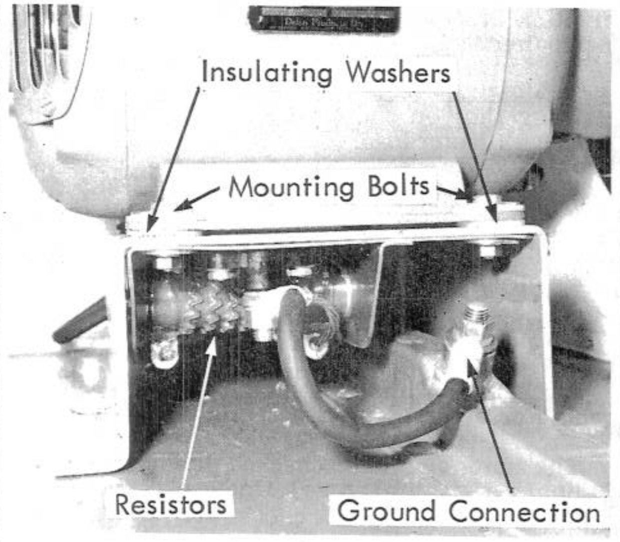


Fig. 16-42: Resistors Mounted Under Motor

condenser motor becomes overloaded and could burn out if limit of circuit breaker is not reached.

The curved fan blades are retained to the floating hub by a lock ring which allows blades to float in correct alignment for balance. No periodic maintenance is necessary other than keeping hub free of dirt to prevent seizure. Care should be taken to prevent bending or distorting outer retaining rings.

REMOVAL

1 Remove the L.H. front baggage compartment panel.

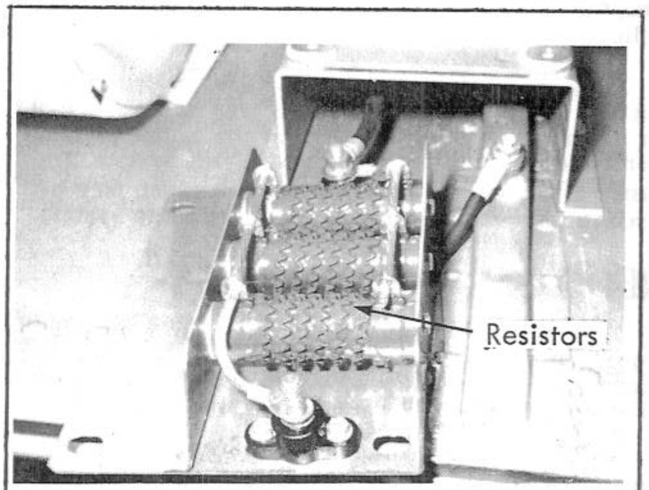


Fig. 16-43: Resistors Dismounted

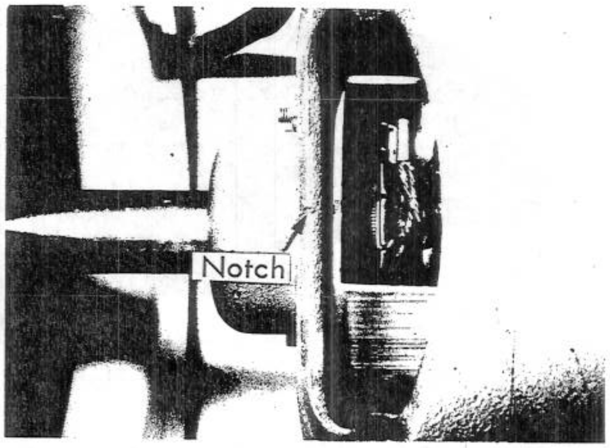


Fig. 16-44: Notch On Condenser Motor

3. Disconnect wiring attached to motor.

4. Remove motor bracket from condenser floor and motor. Condenser motor and fan wheels may then be removed from the condenser compartment through the baggage compartment.

Care must be taken that condenser compartment seals are in good condition. Air circulation in coach will be impaired if leaks occur and air is drawn from baggage compartment.

A resistor assembly is mounted under the condenser motor mounting base.

The assembly consists of 3 high-wattage resistors, connected in parallel and is installed in the 2 h.p. condenser motor ground circuit.

The resistor assembly dampens the current inrush at motor starts, thus prolonging the armature and brush life.

MAINTENANCE

1) Turn main battery disconnect switch to "OFF" position before doing any work on the electrical components.

2) Remove the four 1-1/4" mounting bolts retaining the motor and resistor assembly.

3) Pull out the resistor assembly for visual inspection. Brush or blow away any foreign particles.

NOTE: If it is necessary to check motor current draw, resistor assembly should be bypassed to obtain correct ammeter reading.

BRUSH ADJUSTMENT

Condenser motor speed and load is controlled by adjusting the brush retaining ring on the motor. Adjustment procedure is:

1) Connect an ampere meter in series with the motor.

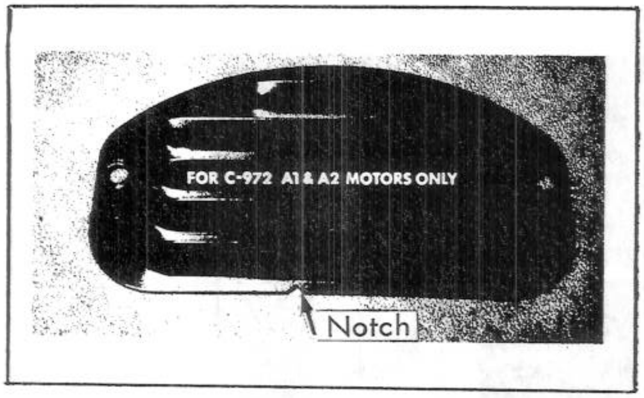


Fig. 16-45: Notched Cover Plate

2) Operate engine at fast idle. Check the ampere draw.

It should register between 50 and 60 amps. at 27½ volts. If not, adjust brush retaining ring to obtain the required specification. Brushes should not be allowed to wear below ¾" in length.

EVAPORATOR

The evaporator is located in the central air circulating chamber behind the heater core (when viewing from front baggage compartment.)

The heater core and fan assembly can be checked by opening the center door in the front baggage compartment.

The evaporator can be checked and cleaned by removing the access panel at the rear of the condenser compartment on the rear bulkhead.

To remove the evaporator, it is necessary to remove the fans and ducts, the heater core and then the evaporator and frame as one assembly.

Periodic cleaning is required to ensure full efficiency and the evaporator should be cleaned with a cleansing agent not harmful to aluminum or copper.

FILTER

The air filter is a metallic cleanable type, filtering all air moving through the system. It is located above the heater core and may be removed after the evaporator compartment door is opened.

The coach should never be operated without this filter because proper circulation would be impaired. All air would bypass from pressure to the suction side of the chamber.

The air filter should be cleaned at regular intervals.

EVAPORATOR FAN & MOTOR

Fans are conventional Sirocco type wheels mounted driven by a 1 H.P. 24 - volt motor. The motor is two-speed type operating at low speed on heating cycle and high speed on air conditioning.

Keep the evaporator compartment seals in good condition otherwise air circulation in the coach will be impaired.

1) Motor speed is controlled by adjusting brush retaining ring on motor. Connect an ammeter in series with motor lead.

2) Operate engine at fast idle. Current draw at low speed should be 30 to 34 amps. at 27½ volts. With "NC" switch on and evaporator motor operating at high speed, current draw should be 38 to 42 amps. at 27½-volts.

Brushes should not be allowed to wear below 3/4 of an inch in length.

CAUTION—Ammeter should be connected so evaporator access door can be closed during tests.

The motor should be checked periodically (every 500 hours of running time). Under extremely dusty conditions more frequent checks are recommended.

The Evaporator Fan with the tapered lock bushing is dynamically balanced. If the bushing is removed for any reason, it should be re-installed in the same position without disturbing the relationship between the two parts.

RECEIVER TANK

The receiver tank is located in the condenser compartment. The sight glasses can be observed by opening the condenser compartment door.

The function of the receiver tank is to store the liquid refrigerant. During normal operation the level of the refrigerant should be approximately at the halfway mark on the lower glass.

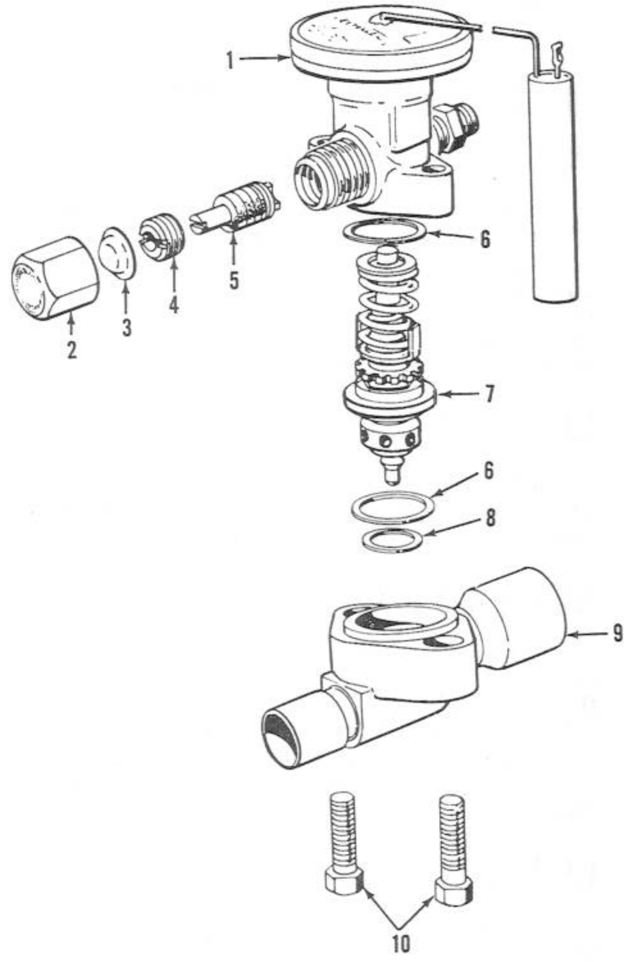
In case of extreme pressure rise, a safety valve (rupture disc type) will break at 385± 20 p.s.i. and relieve the tank pressure.

The receiver tank incorporates a backseating valve on the inlet which allows the tank to be isolated or serviced. A shut-off valve at the outlet permits complete isolation from the rest of the system. The tanks also includes a 1/4" purge cock which may be used to remove air or excess Freon from the system.

REFRIGERANT CHARGE

The system requires 21 lbs. of Freon 12 and the liquid should be approximately ½ in lower sight glass after 30 minutes of engine operation in fast idle with coach interior at approximately 70°.

Refrigerant liquid should never be visible in upper sight glass and refrigerant should not be added unless the system has been operated as previously outlined.



1. Power Element
2. Cap - Seal (Nut)
3. Bonnet - Seal (Flare)
4. Packing Nut
5. Adjusting Stem & Packing Assy
6. Gaskets
7. Cage Assy.
8. Gasket
9. Body Flange
10. Cap Screw

Fig. 16-46: Expansion Valve

FILTER-DRYER

This filler is located between the receiver tank and expansion valve. It is used to absorb moisture from the refrigerant. The filter should be replaced if the system has been open to prolonged exposure as shown by the moisture indicator or if plugged.

A plugged dehydrator is indicated by differences in temperatures on either side of the dehydrator.

REPLACEMENT

Pump down the system by isolating the refrigerant in the receiver and reducing pressure at the dryer.

1) Install a service gauge at the compressor.

2) Close off the outlet from the receiver tank.

3) Run the compressor until the low side of the system is evacuated.

4) Change dehydrator element.

5) Admit a small quantity of Freon to the low side of the system. Check for leaks. Return the system to normal operation.

CAUTION: Do not use carbon tetrachloride or similar solvent to clean parts. DO NOT use steam guns. Use mineral spirits, white gasoline or naphtha. All parts should be thoroughly cleaned. Use a stiff brush to wash dirt from grooves, holes, etc.

EXPANSION VALVE

The expansion valve is a thermo-sensitive valve with a remote control bulb head attached to the evaporator outlet line. The valve regulates the flow of liquid refrigerant into the evaporator coils and is controlled by the suction gas temperature leaving the evaporator.

The bulb head senses the gas refrigerant temperature as it leaves the evaporator. High temperature will cause expansion and pressure on the power head and spring. Such action causes the power assembly valve to open, allowing a flow of liquid refrigerant into the evaporator.

The spring is adjusted to give 8° - 12° of superheat at the evaporator outlet. This ensures the refrigerant leaving the evaporator is in a completely gaseous state when drawn into the suction side of the compressor. Liquid would damage the compressor valves, pistons and heads if allowed to return in the suction line.

ADJUSTMENT (SUPERHEAT)

An adjusting screw is located under the cap nut on the valve body. To adjust the valve:

1) Operate coach for at least one-half hour with temperature controls set at 78°.

2) Attach a remote reading thermometer to the evaporator outlet line near the expansion valve remote control bulb.

3) Use thermomastic tape to insulate around bulb and evaporator outlet line.

4) Install gauges at compressor gauge connections and record readings.

5) Relate compressor suction pressure to temperature reading according to temperature chart. (Example: Suction pressure 30 p.s.i. converted to 32 degrees on chart. If temperature reading is 40 degrees, subtract 32 degrees and the result will be 8 degrees of superheat.)

CAUTION — Before adjusting expansion valve, check for restriction on suction side for plugged dehydrator and partially opened valves. These conditions will give a high superheat.

MAINTENANCE

1) Pump down the system as directed on page of this section.

2) Disconnect the external equalizer line from the under side of the power head and unclamp the remote control bulb from the evaporator coil outlet line.

3) Remove the two cap screws holding the power assembly to the valve body flange. Lift off the power assembly and remove the cage assembly.

When reassembling, replace with new gaskets in proper place. Be sure the two lugs on the cage assembly fit into grooves provided in the power assembly. **DO NOT** force the valve together. The cage must fit properly before tightening the body flange. Tighten bolts evenly.

CAUTION — If necessary to make a soldered connection, first remove the power and cage assemblies and all gaskets. Keep heat away from all parts except the body flange, particularly the remote control bulb.

ELECTRICAL CONTROLS

BLOWER CUT-IN RELAY

This relay is located in the rear junction panel in the L.H. side of the engine compartment.

When the alternator is in operation, the relay cuts in, supplying current to the A/C and Heating control switch on the driver's panel. Activation of this switch supplies current to the magnetic switches for the evaporator and condensor motors.

LINES & FITTINGS

All lines are copper tubing or Aeroquip #1540 hose. The copper lines have soldered joints and the large hose connections have a rubber "O" ring seal.

SOLDERING

Before soldering any part of the system, make sure the area is well ventilated. Use (Stay Clean) flux sparingly and apply solder (95-5 round wire 1/8"). After completing repairs, test for leaks.

When using heat at or near a valve, wrap with a water saturated rag to prevent over-heating of vital parts.

LEAK TESTING

The most common method used is a Halide torch consisting of an acetylene tank, a burner and a suction test hose.

CAUTION: Do not inhale fumes from leak detector.

The flow of acetylene to the burner causes a suction in the test line. Any refrigerant gas present will be drawn through the hose and into the burner where it decomposes into free acids.

These acids come in contact with the hot copper reaction plate in the burner, causing color reaction in the flame. A small concentration is indicated by a green tint and a large concentration by an intense blue.

Do not confuse this change in color with the change caused by shutting off the air supply through the hose by holding the end too close to an object.

The procedure for testing is:

1) Adjust flame so the top of the cone is approximately level or within one-half inch above the plate.

2) Probe end of suction test tube around all joints, valves, etc. When a leak has been found at a soldered joint, that section of the system must be pumped down. **DO NOT** solder if pressure exists in the joint as pressure will force hot solder

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-17

out.If the system is empty, it is more economical to put in just enough Freon to produce about 15 p.s.i. The pressure can then be raised to about 150 p.s.i. with dry nitrogen.

NOTE: This gas is put into the suction and discharge shut-off valves at the compressor. The receiver valves must also opened. If no leaks are found, dump this mixture, evacuate the system and charge with refrigerant.

TEMPERATURE PRESSURES

The refrigerant temperature-pressure chart is used for adjusting the superheat and checking for air in the system.

TEMP.	PRESS.	TEMP.	PRESS.
-20	0.5	80	84
-16	2	84	90
-12	4	88	96
- 8	5	92	103
- 4	7	96	110
- 0	9	100	117
4	11	104	125
8	13	108	132
12	16	112	140
16	18	116	149
20	21	120	158
24	24	124	167
28	27	128	176
32	30	132	186
36	33	136	196
40	37	140	207
44	41	144	218
48	45	148	229
52	49	152	241
56	53	156	253
60	58	160	265
64	62	164	278
68	68	168	291
72	73	172	305
76	78	176	320

PRESSURE SWITCHES

The Hi-Lo pressure cut-out switch prevents the operation of the system when refrigerant pressures are above or below preset limits.

When pressures exceed the limits, the switch interrupts the loading solenoid circuit and unloads compressor. Low pressure cut-out and cut-in limits are adjustable; high pressure cut-out limit is adjustable, but the cut-in limit is fixed and non-adjustable.

TESTING HI-LO PRESSURE SWITCH

1) Connect test light to stud #4 on junction block to check Hi-Lo pressure switch.
2) Install service gauges at the compressor suction and discharge shut-off valves.
3) Operate the air conditioning allowing the system to stabilize. (Approx. 10 min.)

Low Pressure: Close suction valve slowly, noting the pressure when the light goes out (4-6 p.s.i.). Open valve slowly and note when light goes on (35-38 p.s.i.).

High Pressure: Open condenser door and cover condenser core if necessary in order to raise the high pressure. Note the pressure when the light goes out (275 p.s.i.). Close the condenser door and note pressure when the light goes on (approx. 220) (p.s.i. not adjustable).

ADJUSTMENT

To make adjustments; remove control cover to permit viewing direct reading scale plates. Gasketed screws in control case can be removed for screwdriver adjustment or adjustment can be made with a service wrench without removing gasketed screws.

Set adjusting screw "A" (Fig. 16-47) at 5 lbs. for the low pressure cut-out limit.

Set adjusting screw "B" at 38 lbs. for the low pressure cut-in limit. (Tolerances ± 3 lbs.)

Set high pressure cut-out screw "C" at 275 lbs. The high pressure cut-in differential is factory-set at approximately 55 lbs. below cut-out pressure.

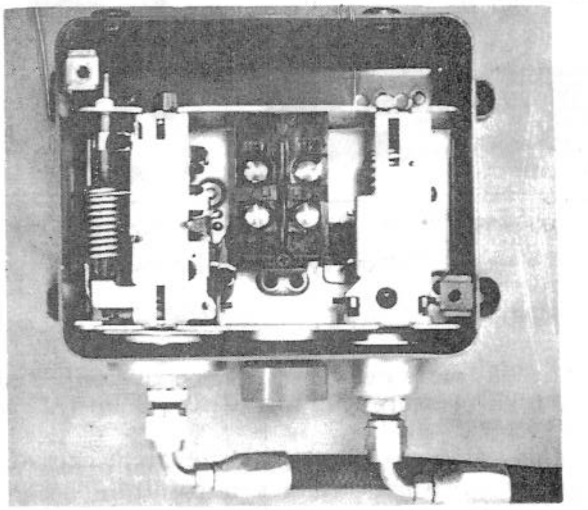


Figure 16 - 47: Hi-Lo Pressure Switch

CAPACITY CONTROL SWITCH

A capacity control switch is mounted above the freon compressor and is connected electrically in the "Loading Circuit" and operates a loading solenoid which controls the operation of one (1) cylinder of the compressor. The capacity control switch senses suction pressure and unloads one cylinder when the suction pressure falls to 27 p.s.i. to reduce refrigeration capacity and driven horsepower load during moderate to light air conditioning requirements.

Dry Nitrogen 40C

TESTING CAPACITY CONTROL SWITCH

1) To check capacity control switch connect test light to terminal M-2 of that switch.
2) Close suction valve slowly noting pressure when test light goes out. (26-28 p.s.i.)
3) Open valve slowly and note pressure when light goes on. (34-36 p.s.i.)

ADJUSTMENT

Turn adjusting screw "A" (Fig. 16-48) to obtain low pressure cut-out of 27 p.s.i.

Turn adjusting screw "B" to obtain a low pressure cut-in of 35 p.s.i.

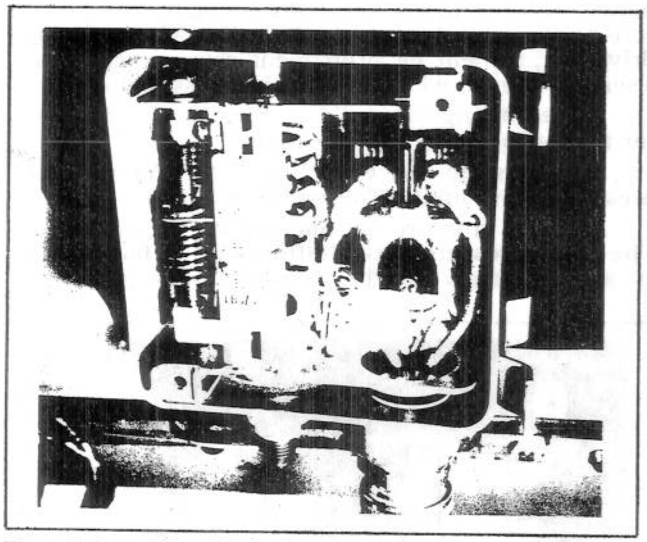


Fig. 16 - 48: High Press. Safety Sw. (Shown)
Capacity Control Sw. (Similar)

HIGH PRESSURE SAFETY SWITCH

A high pressure safety switch is connected to the high pressure side of the refrigerant system at the receiver tank.

This switch provides protection from excessive refrigerant pressure. When a malfunction occurs within the compressor unloading system the switch is activated and turns on the condenser blower when refrigerant pressure is in excess of 275 p.s.i. regardless whether the A/C master switch is "ON" or "OFF".

Such action removes heat from the condenser coil and reduces refrigerant pressure. The operation is automatic, and will operate regardless of the heating and air conditioning switch position.

In the normal position, the switch contacts enable the operator to control the condenser blower motor by the A/C & Heating switch.

In a high pressure condition, the safety switch contacts feed power directly from the battery buss bar to the condenser motor magnetic switch and the A/C warning light.

In turn, the magnetic switch feeds power directly from the buss bar to the condenser blower motor. As pressure falls to approximately 250 p.s.i. the switch returns to normal operation.

TESTING HIGH PRESSURE SAFETY SWITCH

To test for proper operation under high pressure:

1) Turn A/C & Heating switch to "OFF" position.

2) Lift off Circuit #57 from Stud #57 at front junction panel (10 Ga. Yellow-Green). Temporarily tape end of this wire.

3) Jumper a hot buss bar and Stud #9 in the rear junction box to feed power directly to the compressor unloading solenoid. Jumper buss bar to Stud 36 to energize the scavenge solenoid.

4) Install a 0-300 (min.) gauge at the compressor discharge service valve.

5) Run engine at fast idle and watch the discharge line pressure. If condenser motor does not cut-in at 275 p.s.i., shut off the system **IMMEDIATELY** and recheck wiring. The condenser motor should then cut-out when refrigerant pressure drops to 250 p.s.i.

ADJUSTMENT

Turn adjusting screw "B" (Fig. 16-48) to obtain a cut-out pressure of 275 p.s.i.

Turn adjusting screw "A" to obtain a cut-in pressure of 250 p.s.i.

PURGE COCK

The purge cock is located in the upper R.H. side of the receiver tank and is used to purge off any non-condensible forms of gases that might accumulate in the system.

Abnormal high head pressures sometime indicate non-condensible gases in the receiver tank. If such is the case, the purge cock should be opened temporarily.

TROUBLESHOOTING

TROUBLE	CAUSE
Low Suction Pressure & Frosting At Dryer Outlet	Clogged filter-dryer element.

Low Oil Level	Check for oil leaks and for a leaking oil seal. Do Not attempt to check oil level unless system has been stabilized at least 20 minutes.
Excessively Cold Suction Line	Loss of contact between the expansion valve bulb and the suction line or sticking of the expansion valve. Check for foreign matter and clean, repair or replace the valve.
Excessively Cold Suction Line & Noisy Compressor	Check superheat adjustment. Check remote bulb contact. Check expansion valve for sticking.
Compressor Squeaks Or Squeals When Running	Check oil level. Replace oil seal.
Noisy Or Knocking Compressor	Check for broken internal parts. Overhaul if required.
Compressor Vibrates	Check and tighten compressor mounting bolts.
Excessively Hot Condenser And High Discharge Pressure	Air or non-condensible gas in system. Purge system.
Low Refrigerant Level	Check for refrigerant leaks and add refrigerant if required.
Suction Pressure Rises Faster Than 5 Pounds Per Minute After Shutdown	Check compressor valve for breakage or damage.
Insufficient Cooling	Check for refrigerant leaks. Check condition of filter screens and motors
Insufficient Air Flow	Dirty or iced evaporator. Dirty air filter. Blowers inactive. Clogged ducts.
No Flow Of Refrigerant Through Expansion Valve	Dehydrator strainer is clogged. Remote bulb has lost charge or expansion valve is defective.
Expansion Valve Hisses. Bubbles In Moisture & Liquid Indicator	Gas in liquid line. Add refrigerant.

Loss of Capacity	Clogged dehydrator. Obstructed or defective expansion valve.
Superheat Too High	Reset superheat adjustment. Check for clogged external equalizer line, or dehydrator.

TEST EQUIPMENT

The following Air Conditioning Test Equipment Kit is recommended for routine servicing of the Challenger Air Conditioning system.

Qty.	Part No.	Description
1	16C-2-92	Air Conditioning Test Equipment Kit—consisting of following parts:
1	16C-2-93	Halide Leak Detector (Bernz-o-matic Model TX-12)
1	16C-2-94	Freon 12-(35 lb. Tank)
3	16C-2-95	Charging Hoses - (Yellow Jacket Hoses) (HCL-36)
1	16C-2-96	Pressure Gauge - 0-400 lbs. with R 12 & R 22 Temperature scales (No. 172 CA 2½")
1	16C-2-97	Compound Gauge - 0-30" Vac. 0-150 lbs. with R 12 & R 22 Temperature scales (No. 174 CA 2½")
1	16C-2-98	Gauge Manifold - with handwheels (877 J)
1	N.P.N.	Socket - 3/8" Drive-Suction Valves (3/8 8-pt.)
1	N.P.N.	Socket - 3/8" Drive-Discharge Valves (5/16 8-pt.)
1	N.P.N.	Socket - 3/8" Drive-Receiver Tank Valve (1/4" 8-pt.)
1	16C-2-99	Thermometer - (Mechanical) to check Superheat - 10° to + 100° (214001)

The above parts are available from Motor Coach Industries, Service Parts Division.

SPECIFICATIONS

COMPRESSOR

Make	Carrier, Model 5F-30
Type	Radial 3-cylinder, unloading
Capacity	7 tons
Oil Pressure (nominal)	40 psig
Oil Capacity	5 pints U.S.
Pulley	8½"-2 groove with Fan Assy.
Drive Belt	8C-27-6
Speed	1,750 rpm

APPROVED COMPRESSOR OILS

Carrier	PP36-2*

Sun Oil Company	Sunisco 4G (dual inhibited)*
Texas Oil Company	Capella DI (wax free)*

***Do not use with silica gel driers.**

The above oils are suitable for use with reciprocating compressors using R-12 or R-22 with evaporator temperatures above -40° F.

Viscosity at 100° F SSU	300 ±20
Viscosity at 210° F SSU	45-50
Specification	PP36-2
P/N PP45EB-408	Case (24-1 qt. cans)

REFRIGERANT

Type	Freon 12 (Dichlorodifluoromethane)
Quantity	21 lbs.

CONDENSER COIL

Make	Carrier (MCI Special) (16B-4-1)

RECEIVER TANK

Make	Carrier (MCI Special) (16B-5-1)

FILTER DRYER

Make	Ansul, T-Flo With Andrite, Model T-30 (16B-10-19) (Do Not Use Silicagel)
Capacity	30 cu. in.

SOLENOID VALVES

Make	Jackes-Evans
Type	OP2 (Normally Open)
Port Size	¼" N.P.T. (Screwed Connections)
Maximum Opening Pressure Differential	250 p.s.i.
Maximum System Pressure	425 p.s.i.
Maximum Operating Pressure Differential	125 p.s.i.

EXPANSION VALVE

Make	Alco, Freon 12 (16B-6-20) Assy. (16B-6-22) Cage

EVAPORATOR COIL

Make	Carrier, (MCI Special) (16B-6-1)

EVAPORATOR FANS & MOTOR

Make (motor)	Delco Products (MCI Special)
Model	C971
Type	2-speed continuous duty
Horsepower	1 H.P.

Volts	24-28 Volt
Rotation	CCW. Commutator End
Amperage Draw	High Speed: 35 - 40 Low Speed: 28 - 35
Speed	High: 3000 rpm Low: 2650 rpm
Capacity of motor & fans	Approx. 1,500 c.f.m. (Installed in coach)

CONDENSER FANS & MOTOR

Make (motor)	Delco Products (MCI Special)
Type	24 volt, 2 H.P. continuous duty
Amperage Draw	55 amps. without resistors
R.P.M.	1750 - 1800 rpm
Capacity of motor & fans	Approx. 4,000 c.f.m. (installed in coach)

AIR FILTER

Make	MCI
Type	Reusable, metallic, cleanable, stainless steel media.

FREON HOSE

Type	Aeroquip 1540

HIGH - LOW PRESSURE SWITCH

Make	Penn
Discharge Pressure	275 cut - out fixed differential 55 p.s.i.
Suction Pressure	5 p.s.i. cut - out 38 p.s.i. cut - in

HIGH PRESSURE SAFETY SWITCH

Make	Penn
Discharge Pressure	275 p.s.i. cut - in 250 p.s.i. cut - out

CAPACITY CONTROL SWITCH

Make	Penn
Cut-out Pressure	27 p.s.i.
Cut-in Pressure	35 p.s.i.

TORQUE VALUES FOR COMPRESSOR BOLTS Table No. 1

Dia. In.	Wrench Size, In. Nut	Allen	Threads Per Inch	Torque Range Foot Pounds
1/4	7/16	3/16	20 Coarse	6-10
5/16	9/16		24 Fine	28-30
5/16	9/16	7/32	18 Coarse	18-22
3/8	5/8	5/16	16 Coarse	30-35
7/16	3/4		20 Fine	42-47
7/16	3/4	5/16	14 Coarse	45-50
1/2	13/16	3/8	13 Coarse	50-60
5/8	15/16		18 Fine	100-120

WEAR LIMITS FOR COMPRESSOR - Table 2

Part Name	Factory Maximum	Factory Minimum	Maximum Wear Before Repair
SEAL END			
Main Bearing Diam.	1.6226		0.002
Main Bearing Journal Diam.		1.6233	0.003
PUMP END			
Main Bearing Diam.	0.6226		0.002
Main Bearing Journal Diam.		1.6233	0.003
CONNECTING ROD			
Bearing Diam. (After Assy)	1.6255		0.002
Bearing Thickness		0.06225	0.001
Crankpin Diam.		0.6233	0.003
CRANKSHAFT Throw	1.0005	0.9985	
THRUST WASHERS (Thickness)			
Seal End		0.129	
Seal End (Steel)		0.155	
Pump End		0.129	
Replace Thrust Washers When End Clearance Exceeds			0.035
CYLINDERS			
Bore	2.501		0.003
Piston (Diam.)		2.4980	0.003
Wrist Pin (Diam.)		0.7498	0.001
Wrist Pin Bushing	0.7507		0.001
Piston Ring End Gap (Comp. and Oil)	0.017	0.007	0.030
Piston Ring Side Clearance (Comp. and Oil)	0.0025	0.001	0.003
OIL PUMP			
*Axial Clearance	0.0015	0.0005	0.0025
Drive Shaft Diam.		0.4354	0.000
Drive Shaft Bushing Diam.	0.4375		0.000
SUCTION VALVE			
Suction Valve Disc (Depth of wear below face)			0.005
Suction Valve Seat		0.012	
Minimum height of "A" (Fig. 16-) before replacing cylinder sleeve (0.010)			
DISCHARGE VALVE			
Discharge Valve Disc .... (Depth of wear below face)			0.005
Discharge Valve Seat		0.012	
Minimum height of "B" (Fig. 16-) before replacing valve plate & discharge valve inner seat (0.010)			

*Return assemblies for factory exchange.

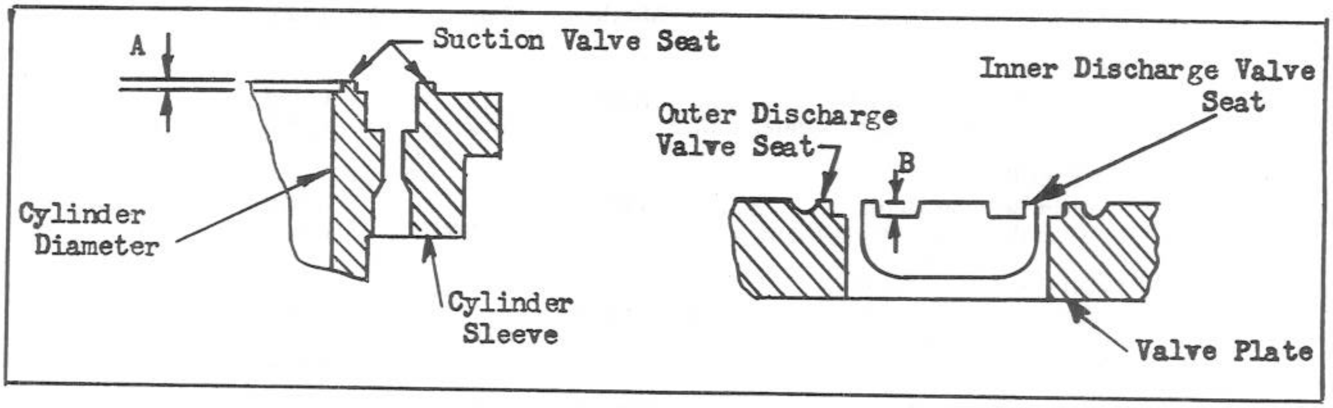

A
Suction Valve Seat
Cylinder Diameter
Cylinder Sleeve
Inner Discharge Valve Seat
Outer Discharge Valve Seat
B
Valve Plate

Figure 16 - 49: Suction And Discharge Valve Wear Limits

LAVATORY

LAVATORY

DESCRIPTION

Washroom facilities located at the rear corner of the vehicle include toilet, wash basin and mirror. The installation of the washroom eliminates two passenger seats on the right side of the rear cross seat. The washroom has a stainless steel non-skid floor with stainless steel bright finish paneling on the lower half of the walls, door and sink partition. The drain is located on the washroom floor to enable thorough cleaning using water under pressure, if desired. Panels faced with permanent finish melamine type material are utilized on the upper half of the washroom partitions for ease of cleaning and resistance to damage. A large mirror is used, covering the entire back wall above the wash basin. A wall-mounted ashtray is installed. Extreme care has been taken in the design of the washroom to avoid corners where dirt may collect. The use of stainless steel enables the washroom to be easily maintained in a pleasing condition at all times as acid stains do not mar the appearance. A fresh water tank is located on the interior of the coach adjacent to the washroom. A single tank waste water and retention tank is used, constructed of stainless steel and incorporating a positive air operated dump arrangement. Servicing of the washroom facilities is by means of two couplings. One for the flushing and filling of the chemical tank and one for the filling of the fresh water tank. For location of servicing facilities refer to Figures 17-4, 17-6 and 17-7. A large overflow line is located in the fresh water to eliminate the possibility of this tank being damaged by excessive water pressure.

VENTILATING BLOWER AND MOTOR

DESCRIPTION

Ventilator blower mounted on chemical tank exhausts objectionable odors and also provides constant air circulation to the lavatory compartment. Air enters the lavatory compartment through a duct on the outer wall which discharges behind the window crash bar.

The exhaust blower runs constantly whenever the master control switch on instrument panel is put in the "on" position.

The blower motor is rubber mounted and can easily be removed from engine compartment by removing 4 nuts and bolts and separating electrical wires at spliced places.

MAINTENANCE

The intervals for preventative maintenance should be determined by coach mileage operated and dirt conditions, however, it is recommended these items be checked approximately every 50,000 miles or 1,700 coach operating hours.

Remove blower and motor assembly. Free operation of blower wheel and motor is important. Check blower housing wheel and ducts. If dirty, they should be cleaned.

Check brush seating and amount of wear, if not seating properly or worn badly, they should be replaced.

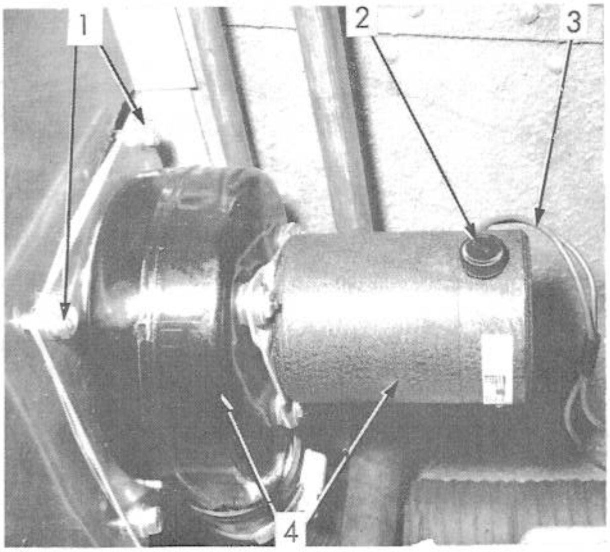
Blower motor brushes can be replaced without having to remove the unit from mounting.

Check bearings for wear, if worn, they should be replaced.

REMOVAL

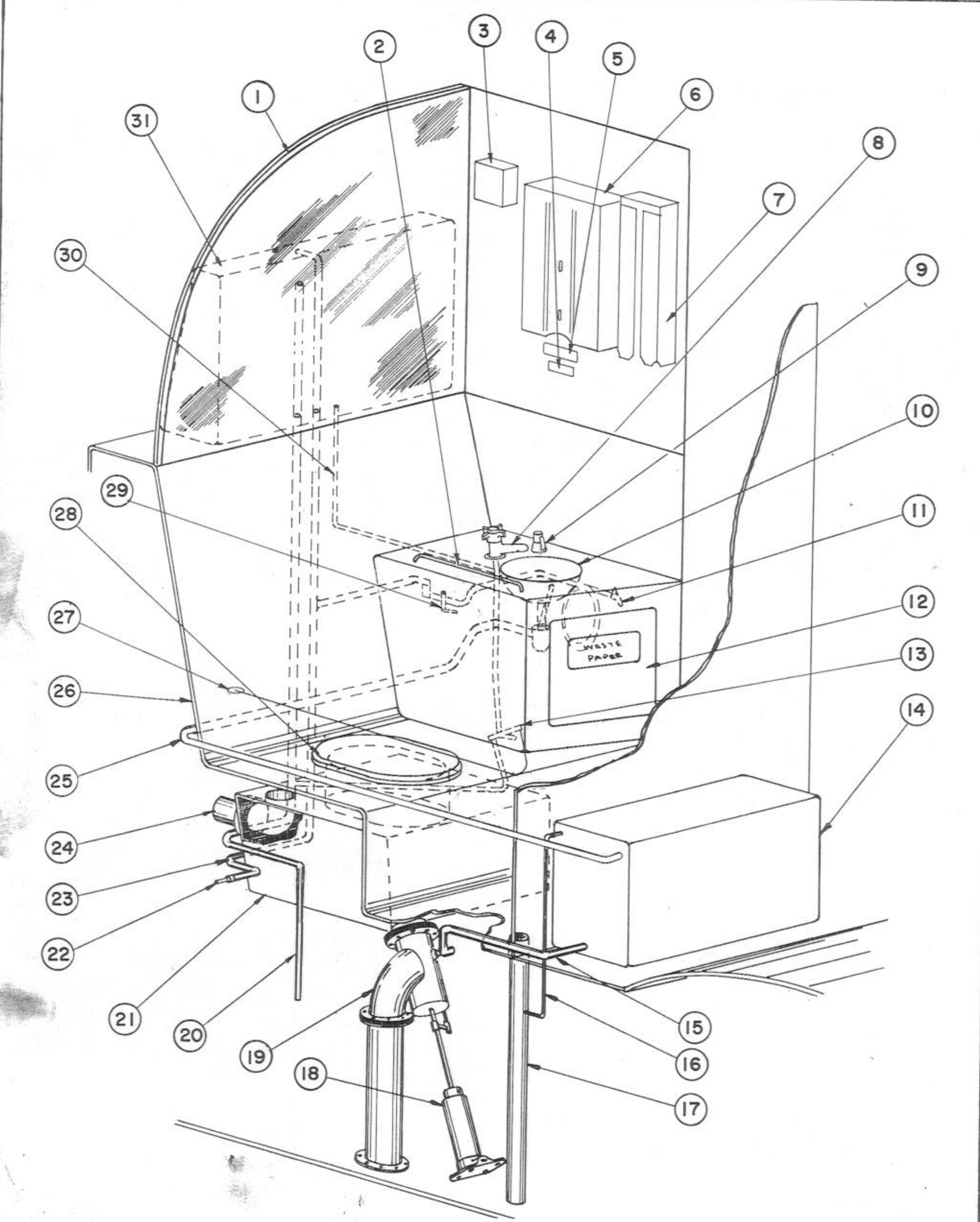
Open right hand rear side service door. Disconnect wiring. **NOTE:** Tape ends for safety purposes. Loosen clamp attaching flexible air hose to blower shroud and remove hose. Remove four capscrews which attach blower assembly, then remove motor with fan and housing assembly.

Note: When mounting exhaust motor on blower assembly rotate motor 180° on its mounting position at the two fixing screws for case mounting to plate, this prevents entry of water etc. when steam cleaning engine compartment.



1. Capscrews
2. Brush Retainer
3. Motor Wiring
4. Blower & Motor Assembly

Figure 17-1: Lavatory Ventilating Blower & Motor Installed


3
4
2
5
1
6
31
8
7
30
9
10
29
11
28
12
WASTE PAPER
13
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16
18
17

Fig. 17-2: Lavatory Components

1. Fresh Water Tank
2. Mirror
3. Deodorizer
4. Towel Dispenser
5. Wet Towel Dispenser (Optional)
6. Nameplate (waste paper disposal)
7. Nameplate (do not drink this water)
8. Wash Basin
9. Nameplate (lavatory door lock)
10. Nameplate (lock door to turn on light)
11. Water Paper Container
12. Sink Trap Drain Line
13. Toilet Seat
14. Lavatory Chemical Tank Dump Tube
15. Fresh Water Tank Fill
16. Air Cylinder
17. Sight Gauge
18. Immersion Heater (Optional)
19. Chemical Tank Drain Valve
20. Chemical Tank Flush
21. Exhaust Fan & Motor
22. Overflow Line - Fresh Water Tank
23. Lavatory Seat & Side Wall
24. Fresh Water Tank and Faucet Drain
25. Grab Rail
26. Faucet
27. Soap Dispenser
28. Thermal Drain Valve (Optional)

FIGURE 17 - 2: Lavatory Components (Cont'd)

INSTALLATION

Place blower motor with fan and housing in position, then attach with four capscrews. Install flexible air hose to blower shroud and attach with clamp. Connect electrical wiring. **NOTE:** Tape the wiring connections securely. Check motor operation.

EMERGENCY BUZZER

Lavatory emergency buzzer is mounted in front junction box and sounds when the emergency switch button in the lavatory compartment is pushed. Refer to wiring diagram for circuit continuity.

EMERGENCY BUZZER SWITCH

The emergency buzzer switch marked "To Signal Driver - Emergency Only" is located on upper right corner of the front partition of the lavatory compartment. A light on the instrument panel marked "Lavatory Alarm" flashes when the switch is depressed and the buzzer sounds.

DOME LIGHT

The lavatory dome light is located on the lavatory ceiling panel. The dome light contains a 6 candlepower bulb that lights with the marker lights and a 32 candlepower bulb that lights when the lavatory is closed and locked.

LAVATORY OCCUPIED SIGN LIGHT

Lavatory occupied sign light is located on the exterior of the forward lavatory compartment partition. This sign which reads "Wash Room Occupied" is illuminated when the lavatory door is closed and locked.

LAVATORY DOOR LOCK

Lavatory door lock installed on door has inside and outside handle and inside latch to lock door from within the compartment. When this latch bolt is locked it automatically turns on the compartment ceiling light and the exterior occupied sign light. If the lock fails to release, the door can then be opened from the outside with a special key which is furnished to the driver.

Lock assembly can be removed from the door, then readily disassembled and parts replaced, if necessary. A light application of lubricant to all moving parts will assure free operation.

DOOR LOCK SWITCH

A miniature switch is installed in the door post at the edge of the front partition. This switch is activated by the door lock mechanism upon locking to energize the 32 candlepower bulb in the compartment dome light and the "Washroom Occupied" sign on the outside wall. The switch is readily serviced by removing the two screws securing the striker plate to the post.

LAVATORY DOOR LOCK AIR CYLINDER (OPTIONAL)

DESCRIPTION

An air operated air cylinder is installed to provide positive closing of the lavatory door, the cylinder also reduces rattles and strain on lock, striker plates and hinge. The cylinder is fed from the coach accessory air supply. A pressure regulating valve and a flow control valve assures a controlled closing action. Refer to section 4 "Brakes & Air System" for detailed maintenance on regulating valve.

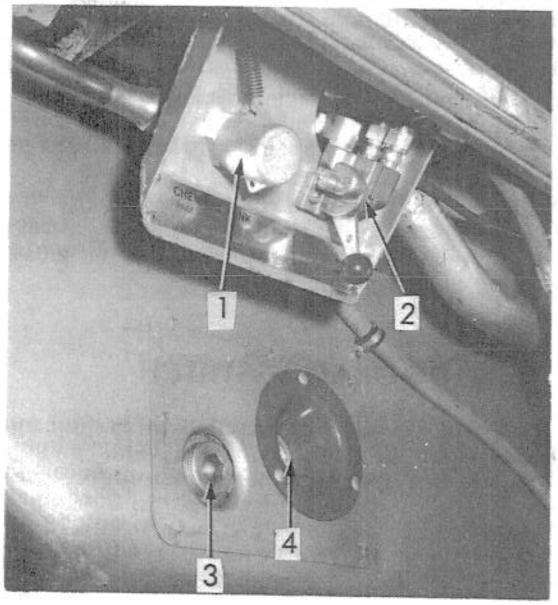
MAINTENANCE

No periodic maintenance is required to the air cylinder.

LAVATORY SERVICE PANEL

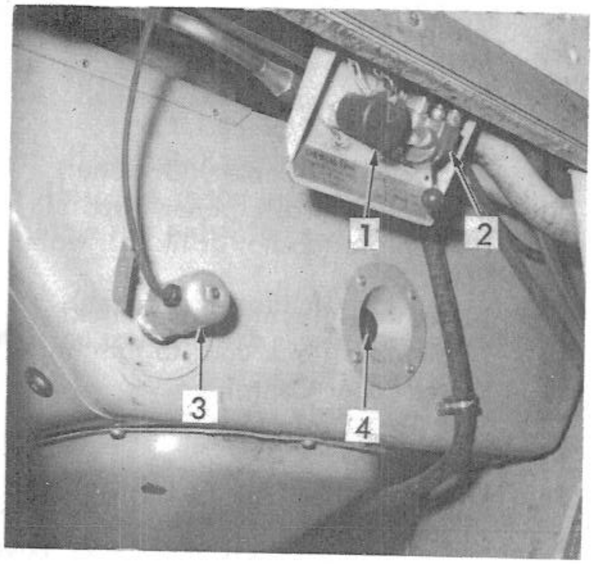
DESCRIPTION

Fresh water fill service panel is located on the exterior right hand rear side. Chemical tank flushing and filling service points are located in the engine compartment above the right hand rear side engine service door. A Hansen 6000 series quick connector is used for flushing and filling the chemical waste tank. A Hansen 5000 series quick connector is used for filling fresh water tank. The chemical tank flushing and filling inlet cap (Unit No. 10001 thru 10543) was spring loaded to exclude dirt from the system. (Effective Unit No. 10544), the cap was changed to a molded vibrin plastic cap. Also, a steel link chain is used to attach the cap to the coach body to prevent loss of cap. The fresh water tank fill cap (Unit No. 10001 thru 10519) was spring loaded, (Effective Unit No. 10520), the cap is replaced by a new lavatory service door assembly which incorporated a cup-shaped spring loaded seal to close off the fresh water fill opening. An air control valve operates a pneumatic dump valve to drain the chemical waste tank. The fresh water tank



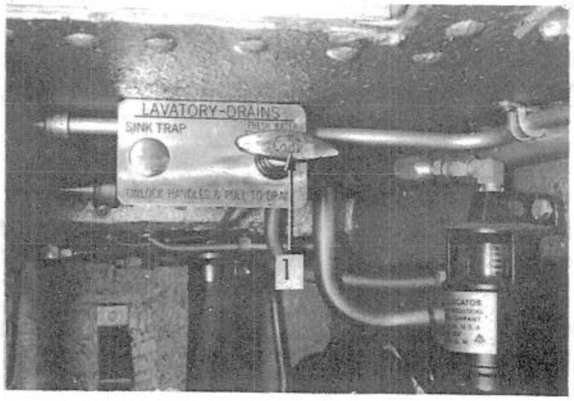
1. Chemical Tank Flushing & Filling Inlet
2. Lavatory Dump Valve
3. Immersion Heater Pipe Plug
4. Chemical Tank Sight Gauge

FIGURE 17 - 3: Lavatory Service Panel (Effective Unit No. 10001 thru 10543)



1. Chemical Tank Flushing & Filling Inlet
2. Lavatory Dump Valve
3. Immersion Heater - Optional
4. Chemical Tank Sight Gauge

FIGURE 17 - 4: Lavatory Service Panel (Effective Unit No. 10544)



1. Fresh Water Line Drain

FIGURE 17 - 5: Fresh Water Drain Valve Handle In Engine Compt.